Section A5 IUCLID: 7.1-7.5	Effectiveness against target organisms and intended uses	
Subsection (Annex Point)		**Official use only**
5.1 Function (IIA5.1)	*Include code(s) and term(s) for fungicide, rodenticide, insecticide, bactericide or other* Fungicide and insecticide (including termaticide) for wood preservatives Main Group: 2 - Preservatives Product Type: 08 – Wood Preservatives **APPLICATION CODE** — **ENGLISH TERM** III.1 — Fungicide III.2 — Insecticide	
5.2 Organism(s) to be controlled and products, organisms or objects to be protected (IIA5.2)	*Non entry field*	
5.2.1 Organism(s) to be controlled (IIA5.2)	*Include term(s) and state common name, scientific name, sex, strain and stadia, if relevant. For complexes of organisms give the generic name; for pathogens the specific name must be given.* The following organisms are representative of the organisms concerned: See Table A5j for full application codes and terms. Wood rotting Basidiomycete fungi (white and brown rot fungi). Application code I.1.1.1. • *Coniphora putanea (brown rot)* • *Poria placenta (brown rot)* • *Gleophyllum trabeum (brown rot)* • *Coriolus versicolor (white rot)* Soft rot fungi. Application code I.1.1.2. • *Chaetomium globosum* Insects. Application code I.2 • Wood boring beetles (Coleoptera), the most important being *Hylotrupes bajulus (House Longhorn)*. Application code I.2.1 and I.2.1.1. • *Anobium punctatum (Common Furniture beetle)*. Application code I.2.1.2. • *Lyctus brunneus (Powder post beetle).*	X1 X2

	Application code I.2.1.4 • Termites (Isoptera) in particular. Application code I.2.2 • *Reticulitermes spp,* • *Kalotermitidae spp*	
5.2.2 Products, organisms or objects to be protected (IIA5.2)	*Include code(s) and term(s) for products, organisms or objects to be protected and the application aim* Timber for use in Hazard Class 1, 2, 3 and 4. **APPLICATION CODE** — **ENGLISH TERM** IV.1 — Indoor use IV.1.1 — Use class 1 IV.1.2 — Use class 2 IV.2 — Outdoor use IV.2.1 — Use class 2 IV.2.2 — Use class 3 IV.2.3 — Use class 4	
5.3 Effects on target organisms, and likely concentration at which the active substance will be used (IIA5.3)	It is known that the biologically active ion derived from the use of copper carbonate is the Cu^{2+} ion in solution. As the active substance is the Cu^{2+} ion, copper carbonate is therefore described as the precursor to release of Cu^{2+} ion. Since Cu^{2+} is the most important component in a copper-containing formulation, most formulations are described in terms of total copper. Therefore, many copper-containing products can be produced with either copper carbonate or copper oxide, and in the past, copper sulphate pentahydrate. Efficacy data on copper usually refers to the amount of total copper present and not the respective copper salt. The data presented below incorporate data on copper sulphate pentahydrate, copper carbonate and copper oxide, but in all cases the Cu^{2+} ion is the recognised active substance. Copper salts such as copper sulphate were initially used as unisalt wood preservatives but their effectiveness and improved resistance to being leached from the treated timber came with the use of other substances such as chromium in conjunction with copper to produce copper/ chromium wood products that were resistant to leaching. Other substances were also used including boron and arsenic to produce copper chrome boron (CBC) and chromated copper arsenate (CCA) preservatives. In recent years alternative technologies have been used to solubilise the copper and enable it to be impregnated into	

	timber in a manner so that it will become bound with the wood structure. The efficacy spectrum and effectiveness of the copper has been further improved by formulating with other biocides. Copper is therefore no longer formulated on its own for use in industrially applied wood preservatives of the preventive type. **Establishing the efficacy of copper** Efficacy claims are made for copper against a range of biological agencies that degrade wood and wood-based products. Efficacy can be established through the use of laboratory tests, simulated field tests and field service. It has been the custom and practice within the wood preservation sector to develop screening tests that are used to decide the basis on whether or not further, and more extensive, field and service tests should be carried out for an active substance or formulated product. As has been described elsewhere, almost without exception, there are no single active substance based wood preservative formulations placed on the market. This is due to the range of organisms to be controlled and the fact that competitive and other pressures encourage optimisation in the proportions of each active substance used in a formulation. The exact composition of a formulation depends on the end use of the treated timber. This has also meant that the reading across of data has to be done in assessing the efficacy of an active substance.	
5.3.1 Effects on target organisms (IIA5.3)	*The description of the effects on target organisms may be based on a summary table of screening and other tests (see specimen of summary table below) in which also the dependence of the effect on the concentration and possible threshold concentrations are indicated. To show possible differences, the use, i.e. product type and method of application of the biocidal product(s) envisaged should also be given.*	
5.3.1.1 Wood-destroying basidiomycete fungi	In the early days of industrial wood preservation test work was done on so-called uni-salt preservatives such as copper sulphate. Price and Watson (1962) reviewed the data that were available for waterborne preservatives and the following information is abstracted from this review. The data contained in Table 5_1 are threshold values obtained for copper sulphate to control wood rotting basidiomycete fungi. The test technique used was a US soil block technique, a technique similar to the BS 838 wood block on agar test which in turn was very similar to EN 113, the current laboratory test method used for assessing the efficacy of active substances and formulations against wood destroying basidiomycete fungi (See Table 5_2).	X3

	These results all show that copper does exert a controlling influence on these fungi however simple copper salts were relatively easily lost from treated wood by water leaching when placed in ground or water contact and this led to the development of more water resistant formulations where other substances were introduced to deposit the copper in an insoluble form in the timber or to facilitate the binding of copper with the wood substrate. In 1981 the International Research Group on Wood Preservation (IRG) published - Some Wood-Destroying Basidomycetes Volume 1, edited by R Cockcroft, a collection of monographs on some wood-destroying basidiomycetes (document number 81/1121). Copper sulphate pentahydrate is a reference preservative listed in the monographs and toxic thresholds obtained using unleached wood blocks are cited for the wood–destroying basidiomycete fungi summarised in Table A5_2. The generic name of many species formally allocated to the genus *Poria* has changed repeatedly over the years and it is also recognised there are species and strains of such species that show copper tolerance. The phenomenon of copper tolerance is usually associated with the ability of the fungus to detoxify the Cu^{2+} ion by complexing it with oxalic acid to produce insoluble copper oxalate. In situations where copper treated wood is challenged by copper tolerant fungi this is usually overcome by the use of a supplementary biocide that has a different mode of action to copper; alternatively the timber can be treated to a very high copper loading (Pohleven et al, 2002).	
5.3.1.2 Soft rotting fungi	The micro-organism typically used as representative of this type of biological degrade is *Chaetomium globosum.* Greaves (1977) showed that single species (*Chaetomium globosum*) innoculum and a mixed species innoculum grown on filter paper impregnated with differing concentrations of copper sulphate solution showed that there was a difference in the degree of growth across the paper between the 3 and the 5 %w/w concentrations. Thornton (1977) used hardwood sawdust impregnated with copper sulphate solution and found that there was excellent growth of the fungus Chaetomium globosum at the 2.4% w/w compared with only moderate growth at a 12% w/w concentration after 12 weeks incubation. It was concluded the copper was having some inhibitory effect on the growth of the soft rotting fungi in these tests.	
5.3.1.3 Wood destroying	Price and Watson (1962) reported toxic thresholds for	

insects	copper sulphate against two important wood destroying insects as follows: *Hylotrupes bajulus* 0.16%w/w	

	Anobium punctatum <0.25%w/w	
5.3.1.4 Termites	The most effective copper based wood preservatives in their effectiveness against termites has been with chromium and arsenic in chromated copper arsenate formulations however amine copper products are also effective against termite species. Ground Proximity Test Performance reports for an Amine Copper (ACQ –C2) product was reported by Preston *et al.,* 2004. After 38 months exposure at two field sites at Hilo Hawaii and Innisfail, Queensland in Australia where subterranean termites are present. The results show that after 38 months the timber species treated (Loblolly and Radiata Pine) to 1.33 kg CuO or 1.06 kg Cu/ m3 still have a 100% sound rating at both sites. The Ground Proximity Decay Test is for out-of-ground contact testing but is considered more severe than the lap- joint tests. The treated test samples are placed on 4 inch cinder concrete blocks to keep the wood off the ground and the blocks and the samples are covered with horticultural shade cloth to maintain a high humidity. The Ground Proximity Decay test is severe because it is carried out in high humidity conditions with moisture trapped between the wood and the concrete blocks and in very warm climates. These conditions are very conducive to attack by wood destroying basidomycete fungi and termites and there is a greater potential for breakdown of the wood preservative. Further evidence of the termiticidal efficacy of copper can be found in Fox *et al.*, 2000. This paper reports laboratory testing using various formulations, including those of copper, plus or minus boron and tebuconazole against *Reticulitermes flavipes* and *Coptotermes formosanus*. Tebuconazole is a fungicide and has no termiticidal properties. Table A5_3 summarises data for a copper-tebuconazole and non-boron containing formulation CBA –A are presented below and shows the retention levels used in	X4
Section A5 **IUCLID: 7.1-7.5**	**Effectiveness against target organisms and intended uses**	

	the tests. Whilst specific toxic thresholds are not given for each termite species the paper concludes that there is a toxic threshold of <3.5 kg/m3 total actives and that the recommended retentions for the US Category H3 of 3.3 kg/m3 and for H4 6.5 kg / m3 total actives are appropriate. Because tebuconazole as no termiticidal activity and no boron is present in the test formulation means that the efficacy shown by the product can be ascribed to copper. The US categories can be considered representative of EU end use hazard categories. To summarise, experimental data showing the toxicity of copper to a number of organisms is shown below. These species are representative of the target organisms that are required to be controlled in the various Use Classes of timber (see Section 2.2) (Table A5_2)	
5.3.2 **Likely concentrations at which the A.S. will be used (IIA5.3)**	*For each product type (PT1 to PTn) given in section 5.5* *See below;*	
5.3.2.1 PT08	It should be noted that these toxic thresholds are one of the criteria taken into account when determining the level of copper required to protect the treated timber in its end use for the required period of time. For this reason the typical use of copper for each Hazard Class is likely to be; HC 1,2,3 < 1.9 kg Cu /m3 sapwood loading HC 4 < 3.53 kg Cu / m3 sapwood loading	
5.4 **Mode of action (including time delay) (IIA5.4)**	*If appropriate, refer to experimental studies given in the summary table in section 5.3.1 or any other studies.* See below	
5.4.1 Mode of action	Copper compounds have been used as fungicides for well over a century. It is considered that the fungicidal properties of copper compounds are dependent on the affinity of the copper ion (Cu^{2+}) for different chemical groups within cells, particularly thiol groups, resulting in the non-specifc denaturation of proteins and enzymes. In addition, it is thought that the ion can interfere with the activity of the pyruvate dehydrogenase system inhibiting the conversion of pyruvate to acetyl CoA within mitochondria (Eaton and Hale, 1993). Copper reacts with most essential elements within a cell. It also reacts with ligands on the cell surface and this can	
Section A5 **IUCLID: 7.1-7.5**	**Effectiveness against target organisms and intended uses**	

	interfere with membrane function. Copper may also act extra-cellulary in the case of fungi and inhibit the production of fungal extracellular enzymes. In the case of termites copper ions act on the gut symbionts killing the gut microflora and fauna and depriving the termite of its ability to digest cellulose.	
5.4.2 Time delay	There is no delay relating to the mode of action of copper, when formulated into a wood preservation product and impregnated into timber. In practice, however, freshly treated wood is held at the treatment plant until dry. It then enters the supply chain and may be stored for a time until being put into service. It is anticipated that around seven days elapse before treated wood is installed.	
5.5 Field of use envisaged (IIA5.5)	*Include code(s) and term(s)* *See Below*	
5.5.1 MG02: Preservatives	*Product types PT06-13* Product Type 8 Industrial preventive wood preservative applied in vacuum pressure timber impregnation plants. Timber treated with this active substance may be placed in the Biological Hazard Classes (also referred to as Use Classes) 1, 2, 3, 4A and 4B as defined in EN 335. **APPLICATION CODE** — **ENGLISH TERM** IV.1 — Indoor use IV.1.1 — Use class 1 IV.1.2 — Use class 2 IV.2 — Outdoor use IV.2.1 — Use class 2 IV.2.2 — Use class 3 IV.2.3 — Use class 4	
5.6 User (IIA5.6)	*Briefly describe the use conditions*	
5.6.1 Industrial	This wood preservative to be used exclusively in industrial timber treatment plants operated by trained personnel. It will not be available to the general public.	
5.6.2 Professional	Not applicable	
5.6.3 General public	Not applicable	
5.7 Information on the occurrence or possible occurrence of the development of resistance and	*Give information on the occurrence of resistance or possible occurrence of the development of resistance and appropriate management strategies. If appropriate, refer to experimental studies given in the summary table in section 5.4 or any other studies.*	

Section A5 **IUCLID: 7.1-7.5**	**Effectiveness against target organisms and intended uses**	
appropriate management strategies (IIA5.7)		

5.7.1	Development of resistance	*See TNsG in support of Annex VI* There are strains of some species of wood destroying fungi that exhibit tolerance to copper. This phenomenon has been known for many years and has been reviewed in Pohleven et al 2002. Generally speaking wood preservative products containing copper require additional biocides in order to control copper tolerant strains of fungi where there is the potential for copper tolerant strains of fungi to be encountered by the treated timber in service. There is no evidence of insects being naturally tolerant of the levels of copper used for biocidal purposes in wood preservation.	
5.7.2	Management strategies	*See TNsG in support of Annex VI* Although there is no potential for development of resistance *per-se*, copper-tolerant strains of fungi are controlled by the use of additional biocides where necessary. As there is no evidence of insects having either a natural tolerance to copper, or being able to develop resistance to copper at the levels used for biocidal purposes in wood preservation, it is considered that there is no requirement for a management strategy.	
5.8	**Likely tonnage to be placed on the market per year (IIA5.8)**	*Confidential*	

	Evaluation by Competent Authorities	
	Use separate "evaluation boxes" to provide transparency as to the comments and views submitted	
	EVALUATION BY RAPPORTEUR MEMBER STATE	
Date	9 July 2009	

Materials and methods	**List of data provided by the task force to support the claim:**
	List of data provided by the task force to support the claim:
	- **A5.3/01. Price E.A.S and Watson, R.W., 1962. Review of water-borne preservatives. Rec. of 12th Annual Convention of the British Wood Preserving and Damp-proofing Association, London**
	  o efficacy on fungi (basidiomycete and rot fungi) and wood borers (*Hylotrupes bajulus* and *Anobium* sp)
	  o Study acceptable
	- **A5.3/02. Cockcroft, R., 1981. Wood Destroying Basidomycetes Vol. 1. IRG 81/1121.**
	  o Bibliography on basidiomycetes fungus
	- **A5.3/03. Pohleven, F., Miha, H., Sam, A & Jaka, B., 2002. Tolerance of wood decay fungi to commercial copper based wood preservatives. IRG Document No. 02-30291.**
	  o Efficacy on copper tolerant fungus
	  o Study acceptable
	- **A5.3/04. Greaves, H., 1977. Potential toxicants for controlling soft rot in hardwoods 1. Laboratory screening tests using a filter paper technique Material und Organismen 12 Bd 1997 Heft.**
	  o Efficacy on soft rot fungi / hard wood
	  o Study acceptable
	- **A5.3/07. Connell, M., Cornfield, J.A. and Williams, G.R., 1993. A New Timber Preservative. Rec of the Annual Convention of the British Wood Preserving and Damp-proofing Association pp 28-36.**
	  o Paper showing the efficacy of a copper-azole formulation on *Hylotrupes bajulus* and *Reticulitermes santonensis*, on soft rot fungi and on basidiomycete fungi
	  o Study acceptable
	- **A5.3/05. Thornton, J.D., 1977. Potential toxicants for controlling soft rot in hardwoods II Laboratory tests using sawdust Material und Organismen 12 Bd 1997 Heft 3**
	  o Efficacy on brown and soft rot fungi
	  o Study acceptable
	- **A5.3/06. Fox, R.F., Pasek, E.A. and Patel, J. Laboratory Termite testing of Copper Boron Tebuconazole. International Research Group on Wood Preservation. Document No. IRG/WP 00-20192.**
	  o Efficacy on termites (*Reticulitermes flavipes* and *Coptotermes formosanus*)
	  o Study acceptable
	- **A5.4.1 Eaton, R.A and Hale, M.D.C., 1993. In: Wood. Decay, Pests and Protection. Chapman and Hall (Publishers).**	

	o Efficacy on the fongicidal effect of copper. o Study acceptable - **A5.4.1(2) Harris,W.V., 1961. Termites. Their Recognition and Control. Published by Longmans; Encyclopedia Britannica, 2009. Britannica Online Encyclopedia. "Termite"; Abe, T., Bignell, D.E. and Higashi, M., 2000. Termites: evolution, sociality, symbioses, ecology. Published by Springer.; Knight, D.J. and Cooke, M. (Ed), 2002. The Biocides Business. Regulation, Safety and Applications. Published by Wiley-VCH Verlag GmbH, Weinheim.; UN, 2000. United Nations Environment Programme, Chemicals. Finding Alternatives to Persistant Organic Pollutants (POPs) for Termite Management. Prepared by members of the UNEP/FAO/Global IPM Facility Expert Group on Termite Biology and Management, Tamashiro, M., Yamamoto, R and Ebesu, R, 1998. Resistance of ACZA Treated Douglas-Fir Heartwood to the Formosan Subterranean Termite. American Wood Preservers' Association.** o Bibliography on the mode of action on termites. No quality assurance identified. Taking into account of the potential influence of the formulation on the efficacy, concentrations proposed of active substance copper (use class 1, 2, 3: ≥ 1,9 kg Cu/m^3; use class 4 : ≥ 3,42 kg Cu/m^3) should be considered as an indicator only. It should be noted that these toxic thresholds are one of the criteria taken into account when determining the level of copper required for protecting the treated timber in its end use for the required period of time. Typical other parameters are penetration, impregnability of wood species and use classes. These data are based on the current state of the art concerning the practical uses of copper-based products during the last decades, related to the expected service life of wooden elements treated with copper-based product.

Conclusion	Applicant ‘s justification and claim are acceptable Trials provided do not meet EN 559 requirements. However, there are consistent data provided showing efficacy of copper against rot and soft fungi, wood borers and termites. According data provided by the Applicant, the claim should be: Product type 8, preventive treatment (use class 1, 2, 3, 4) against rot and soft fungi, wood borers and termites. A full complete efficacy data package with the exact composition of a formulation will be required to support authorisation of products at the Member State level, for all claimed target organisms.
Reliability	-
Acceptability	acceptable.
Remarks	There is no claim concerning the efficacy of copper on blue stain and mould, although efficacy against these organisms is well known and documented. X1: *Coniophora* instead of *Coniphora* *X2: Gloeophyllum instead of Gleophyllum* X3: The similarity between test techniques has not been demonstrated X4. The Preston *et al.* (2004) study has not been provided
	COMMENTS FROM ...
Date	*Give date of comments submitted*
Results and discussion	*Discuss additional relevant discrepancies referring to the (sub)heading numbers and to applicant´s summary and conclusion.* *Discuss if deviating from view of rapporteur member state*
Conclusion	*Discuss if deviating from view of rapporteur member state*
Reliability	*Discuss if deviating from view of rapporteur member state*
Acceptability	*Discuss if deviating from view of rapporteur member state*
Remarks	

Table 5_1 Application Codes and Common English Terms for Organisms to be Controlled by Active Substance

APPLICATION CODE	SCIENTIFIC NAME	COMMON ENGLISH NAME
I.1.1.1		wood rotting basidiomycetes
I.1.1.2.		soft rot fungi
I.2.		insects
I.2.1		beetles
I.2.1.1	*Hylotrupes bajulus L.*	house longhorn beetle
I.2.1.2	*Anobium punctatum De Geer*	common furniture beetle
I.2.1.4	*Lyctus brunneus*	powder post beetles
I.2.2		termites

Table 5_2: Summary table of experimental data on the effectiveness of the active substance against target organisms at different fields of use envisaged, where applicable

Function	Field of use envisaged	Test substance	Test organism(s)	Test method	Test conditions	Test results: effects, mode of action, resistance	Reference*)
Include respective code(s) for function type(s) given in section 5.1	*Include respective code(s) for product type(s) given in section 5.5*	*Describe specification if deviating from that given in section 2*	*Specify species, strain, sex, weight, growth stage etc. as appropriate*	*Shortly describe test system and application method used in the tests*	*Shortly describe test conditions including concentrations applied and exposure time*	*Describe relevant results; quantify the effects on target organisms; indicate the dependence on the concentrations of the A.S. and the possible existence of a threshold concentration.* *Also describe if results indicate the mode of action and/or the development of resistance.*	*Only author(s) and year of publication/ report; full bibliographic data in footnote*
Basidio-mycete fungi	PT 08	Cu^{2+} (delivered as copper sulphate)	**Lentinus lepidius**	Pine blocks (equivalent to EN 113)	Not available	2.99 kg $CuSO_4.5H_2O$ equivalent to 0.76 kg Cu (threshold values obtained for copper sulphate to control wood rotting basidiomycete fungi)	Price & Watson (1962)
Basidio - mycete fungi	PT 08	Cu^{2+} (delivered as copper sulphate)	*Lenzites trabea*	Pine blocks (equivalent to EN 113)	Not available	4.81 – 6.70 kg $CuSO_4.5H_2O$ equivalent to 1.22 - 1.70 kg Cu (threshold values obtained for copper sulphate to control wood rotting basidiomycete fungi)	Price & Watson (1962)
Basidio-mycete fungi	PT 08	Cu^{2+} (delivered as copper sulphate)	*Poria monticola*	Pine blocks (equivalent to EN 113)	Not available	4.89 - 8.49 kg $CuSO_4.5H_2O$ equivalent to 1.24 - 2.16 kg Cu (threshold values obtained for copper sulphate to control wood rotting basidiomycete fungi)	Price & Watson (1962)
Basidio-mycete fungi	PT 08	Cu^{2+} (delivered as copper sulphate)	*Polyporus versicolor*	Oak blocks (equivalent to EN 113)	Not available	0.88 - 1.69 kg $CuSO_4.5H_2O$ equivalent to 0.22 - 0.43 kg Cu (threshold values obtained for copper sulphate to control wood rotting basidiomycete fungi)	Price & Watson (1962)

Function	Field of use envisaged	Test substance	Test organism(s)	Test method	Test conditions	Test results: effects, mode of action, resistance	Reference*)
Include respective code(s) for function type(s) given in section 5.1	*Include respective code(s) for product type(s) given in section 5.5*	*Describe specification if deviating from that given in section 2*	*Specify species, strain, sex, weight, growth stage etc. as appropriate*	*Shortly describe test system and application method used in the tests*	*Shortly describe test conditions including concentrations applied and exposure time*	*Describe relevant results; quantify the effects on target organisms; indicate the dependence on the concentrations of the A.S. and the possible existence of a threshold concentration.* *Also describe if results indicate the mode of action and/or the development of resistance.*	*Only author(s) and year of publication/ report; full bibliographic data in footnote*
Basidio-mycete fungi	PT 08	Cu^{2+} (delivered as copper sulphate)	*Coniophora putanea*	unleached wood blocks	Not available	3.7 - 7.6 kg $CuSO_4.5H_2O/m^3$ wood equivalent 0.94 - 1.93 kg Cu (threshold values obtained for copper sulphate to control wood rotting basidiomycete fungi)	Cockcroft, 1981
Basidio-mycete fungi	PT 08	Cu^{2+} (delivered as copper sulphate)	*Coriolus versicolor*	unleached wood blocks	Not available	0.25 - 0.40 kg $CuSO_4.5H_2O/m^3$ wood equivalent 0.06 - 0.10 kg Cu (threshold values obtained for copper sulphate to control wood rotting basidiomycete fungi)	Cockcroft, 1981
Basidio-mycete fungi	PT 08	Cu^{2+} (delivered as copper sulphate)	*Lentinus lepideus*	unleached wood blocks	Not available	0.4 - 0.8 kg $CuSO_4.5H_2O/m^3$ wood equivalent 0.036 - 0.071 kg Cu (threshold values obtained for copper sulphate to control wood rotting basidiomycete fungi)	Cockcroft, 1981
Basidio-mycete fungi	PT 08	Cu^{2+} (delivered as copper sulphate)	*Serpula lacrymans*	unleached wood blocks	Not available	3.0 - 3.8 kg $CuSO_4.5H_2O/m^3$ wood equivalent 0.76 - 0.97 kg Cu (threshold values obtained for copper sulphate to control wood rotting basidiomycete fungi)	Cockcroft, 1981
Basidio-mycete	PT08	Cu^{2+} (delivered as a copper amine	*Antrodia vaillantii* DFPG 6911 New Zealand.	Two elements: 1. A non-standard	1. Cu concentrations	This study has been included to support the discussion relating to the phenomenon of copper tolerance. As such, it was concluded that copper	Pohleven et al, 2002

Function	Field of use envisaged	Test substance	Test organism(s)	Test method	Test conditions	Test results: effects, mode of action, resistance	Reference*)
Include respective code(s) for function type(s) given in section 5.1	*Include respective code(s) for product type(s) given in section 5.5*	*Describe specification if deviating from that given in section 2*	*Specify species, strain, sex, weight, growth stage etc. as appropriate*	*Shortly describe test system and application method used in the tests*	*Shortly describe test conditions including concentrations applied and exposure time*	*Describe relevant results; quantify the effects on target organisms; indicate the dependence on the concentrations of the A.S. and the possible existence of a threshold concentration.* *Also describe if results indicate the mode of action and/or the development of resistance.*	*Only author(s) and year of publication/ report; full bibliographic data in footnote*
fungi		preservative, chromated copper borate, copper naphthenate or copper sulphate)	*Antrodia vaillantii* HUM Germany. *Antrodia vaillantii* ZIM L037 Raspor *et al.*, 1995. *Antrodia vaillantii* BAM 190. *Poria monticola* BAM 102. *Leucogyrophania pinastri.* *Gloeophyllum trabeum* ZIM L017 Raspor *et al.*, 1995	screening test carried out on potato dextrose agar. 2. A test conducted to EN 113	5 x 10^{-4}, 1 x 10^{-3}, 5 x 10^{-3}, 1 x 10^{-2}, 2.5 x 10^{-2} mol/l. 2. Cu concentration not stated.	tolerance is attributable to the production of oxalic acid by relevant fungi, which reacts with Cu^{2+} ions to form insoluble copper oxalate. The addition of supplementary biocides or use of very high copper loadings will overcome fungal tolerance. It is not appropriate to apply the concept of a 'toxic threshold' to data of this type.	

Function	Field of use envisaged	Test substance	Test organism(s)	Test method	Test conditions	Test results: effects, mode of action, resistance	Reference*)
Include respective code(s) for function type(s) given in section 5.1	*Include respective code(s) for product type(s) given in section 5.5*	*Describe specification if deviating from that given in section 2*	*Specify species, strain, sex, weight, growth stage etc. as appropriate*	*Shortly describe test system and application method used in the tests*	*Shortly describe test conditions including concentrations applied and exposure time*	*Describe relevant results; quantify the effects on target organisms; indicate the dependence on the concentrations of the A.S. and the possible existence of a threshold concentration.* *Also describe if results indicate the mode of action and/or the development of resistance.*	*Only author(s) and year of publication/ report; full bibliographic data in footnote*
Soft rotting fungi	PT 08	Cu^{2+} (delivered as copper sulphate)	*Chaetomium globosum* Kunze *Cephalosporium acremonium* A mixed inoculum of finely ground soft-rotted wood	A non-standard screening test carried out on filter paper.	Filter papers impregnated with copper sulphate solutions at concentrations of 0.9, 3, 5 and 7 % w/v were inoculated with test species.	'Excellent fungal growth seen in *Chateomium globosum* and in a mixed inoculum in the presence of 3% w/v copper sulphate was reduced to 'moderate' at 5% w/v copper sulphate. The 'toxic threshold' in this study may therefore be set at 3 – 5 % w/w copper sulphate (0.77 – 1.28 % w/v Cu). Poor growth of Cephalosporium acremomium was seen at the lowest copper sulphate concentration tested.	Greaves, 1977
Soft rotting fungi	PT 08	Cu^{2+} (delivered as copper sulphate)	*Gloeophylum trabeum* A mixed inoculum of finely ground soft-rotted wood	A non-standard screening test carried out in samples of spotted gum tree sawdust.	Copper sulphate concentrations in the sawdust were 0.099, 0.48, 2.4 and 12% w/w.	After an incubation period of 12 weeks, soft rot fungi showed only 'moderate' growth on hardwood sawdust containing copper sulphate at a concentration of 12 % w/w, compared with 'excellent' growth at a concentration of 2.4 % w/w. The 'toxic threshold' in this study may therefore be set at 2.4 – 12 % w/w copper sulphate (0.61 – 3.06 % w/v Cu).	Thornton, 1977
Mode of action against wood rotting	PT08	Not applicable	Not applicable	Not applicable	Not applicable	Fungicidal properties of copper ions depend on the affinity of Cu^{2+} for different chemical groups within cells, particularly thiol groups, resulting in the non-specific denaturation of proteins and enzymes. Copper ions may also interfere with the	Eaton and Hale (1993)

Function	Field of use envisaged	Test substance	Test organism(s)	Test method	Test conditions	Test results: effects, mode of action, resistance	Reference*)
Include respective code(s) for function type(s) given in section 5.1	*Include respective code(s) for product type(s) given in section 5.5*	*Describe specification if deviating from that given in section 2*	*Specify species, strain, sex, weight, growth stage etc. as appropriate*	*Shortly describe test system and application method used in the tests*	*Shortly describe test conditions including concentrations applied and exposure time*	*Describe relevant results; quantify the effects on target organisms; indicate the dependence on the concentrations of the A.S. and the possible existence of a threshold concentration.* *Also describe if results indicate the mode of action and/or the development of resistance.*	*Only author(s) and year of publication/ report; full bibliographic data in footnote*
fungi						activity of the pyruvate dehydrogenase system, thereby inhibiting conversion of pyruvate to acetyl CoA within mitochondria.	
Termatocit e	PT 08	Cu^{2+} (delivered as copper carbonate)	*Coniophora putanea* BAM 15*	EN113 plus EN84 leaching regime	Not available	0.53 – 1.56 toxic threshold (Kg Cu / m^3 wood) as defined by test method	Connell et al 1993
Termatocit e	PT 08	Cu^{2+} (delivered as copper carbonate)	*Coriolus versicolor* CTB863A*	EN113 plus EN84 leaching regime	Not available	< 0.53 toxic threshold (Kg Cu / m^3 wood) as defined by test method	Connell et al 1993
Termatocit e	PT 08	Cu^{2+} (delivered as copper carbonate)	*Gleophyllum trabeum* BAM109	EN113 plus EN84 leaching regime	Not available	< 0.54 toxic threshold (Kg Cu / m^3 wood) as defined by test method	Connell et al 1993
Termatocit e	PT 08	Cu^{2+} (delivered as copper carbonate)	**Poria placenta** F PRL 280*	EN113 plus EN84 leaching regime	Not available	0.53 – 1.13 toxic threshold (Kg Cu / m^3 wood) as defined by test method	Connell et al 1993
Termatocit e	PT 08	Cu^{2+} (delivered as copper	Soft rot**	prENV807 vermiculite / Pine	Not available	< 0.54 toxic threshold (Kg Cu / m^3 wood) as defined by test method	Connell et al 1993

Function	Field of use envisaged	Test substance	Test organism(s)	Test method	Test conditions	Test results: effects, mode of action, resistance	Reference*)
Include respective code(s) for function type(s) given in section 5.1	*Include respective code(s) for product type(s) given in section 5.5*	*Describe specification if deviating from that given in section 2*	*Specify species, strain, sex, weight, growth stage etc. as appropriate*	*Shortly describe test system and application method used in the tests*	*Shortly describe test conditions including concentrations applied and exposure time*	*Describe relevant results; quantify the effects on target organisms; indicate the dependence on the concentrations of the A.S. and the possible existence of a threshold concentration.* *Also describe if results indicate the mode of action and/or the development of resistance.*	*Only author(s) and year of publication/ report; full bibliographic data in footnote*
		carbonate)					
Termatocite	PT 08	Cu^{2+} (delivered as copper carbonate)	Soft rot**	PrENV807 soil / Pine	Not available	1.09 toxic threshold (Kg Cu / m^3 wood) as defined by test method	Connell et al 1993
Termatocite	PT 08	Cu^{2+} (delivered as copper carbonate)	**Hylotrupes bajulus** House Longhorn beetle	EN73 plus EN 84 leaching regime	Not available	0.28 – 0.49 toxic threshold (Kg Cu / m^3 wood) as defined by test method	Connell et al 1993
Termatocite	PT 08	Cu^{2+} (delivered as copper carbonate)	*Reticulitermes santonensis* Subterranean termite species	EN117 plus EN84 leaching regime	Not available	1.53 – 1.92 toxic threshold (Kg Cu / m^3 wood) as defined by test method	Connell et al 1993
Termatocite	PT 08	Cu^{2+} (delivered as 25:1 copper: tebuconazole)	*Reticulitermes flavipes* *Coptotermes formosanus*	AWPA Standard E1-97	Southern yellow pine wafers were treated at nominal formulation retentions of 3.3, 4.9 and 6.5 kg/m^3	< 3.5 toxic threshold (Kg total actives/m^3 wood) as defined by test method. As tebuconazole is a fungicide and has no termiticidal properties, the efficacy seen in the copper azole treatments without boron is attributable to the presence of copper.	Fox et al, 2000

Function	Field of use envisaged	Test substance	Test organism(s)	Test method	Test conditions	Test results: effects, mode of action, resistance	Reference*)
Include respective code(s) for function type(s) given in section 5.1	*Include respective code(s) for product type(s) given in section 5.5*	*Describe specification if deviating from that given in section 2*	*Specify species, strain, sex, weight, growth stage etc. as appropriate*	*Shortly describe test system and application method used in the tests*	*Shortly describe test conditions including concentrations applied and exposure time*	*Describe relevant results; quantify the effects on target organisms; indicate the dependence on the concentrations of the A.S. and the possible existence of a threshold concentration.* *Also describe if results indicate the mode of action and/or the development of resistance.*	*Only author(s) and year of publication/ report; full bibliographic data in footnote*
Mode of action against termites	PT08	Not applicable	Not applicable	Not applicable	Not applicable	Copper-based termiticides are “stomach poisons” that result in the death of the target organism by starvation following removal of symbiotic intestinal protozoa.	Harris,W.V., 1961. Encyclopedia Britannica, 2009. Abe, et al., 2000. Knight and Cooke, 2002. UN, 2000. Tamashiro et al., 1998.

* wood destroying fungi
** micro-fungi

References:
List the references cited in alphabethical order with full bibliographic data (Author(s) (year) Title. Source)

Cockcroft, R., (1981) Wood Destroying Basidomycetes. Vol 1. IRG Document No. 81/1121

Connell, M., Cornfield, J.A. & Williams, G.R. (1993). A New Timber Preservative. Rec. Of Annual Convention of the British Wood Preserving and Damp Proofing Association, pp28-36.

Encyclopedia Britannica, 2009. Britannica Online Encyclopedia. “Termite”.

Fox, R.F., Pasek, E.A. and Patel, J. Laboratory Termite testing of Copper Boron Tebuconazole. International Research Group on Wood Preservation. Document No. IRG/WP 00-20192.

Greaves, H., 1977. Potential toxicants for controlling soft rot in hardwoods 1. Laboratory screening tests using a filter paper technique Material und Organismen 12 Bd 1997 Heft.

Harris,W.V., 1961. Termites. Their Recognition and Control. Published by Longmans.

Knight, D.J. and Cooke, M. (Ed), 2002. The Biocides Business. Regulation, Safety and Applications. Published by Wiley-VCH Verlag GmbH, Weinheim.

Pohleven, F., Miha, H., Sam, A & Jaka, B., (2002). Tolerance of wood decay fungi to commercial copper based wood preservatives. IRG Document No. 02-30291.

Price, E.A.S., & Watson, R.W. (1962) Review of Water Borne Preservatives. Rec. of 12th Annual Convention of the British Wood Preserving and Damp Proofing Association, London.

Tamashiro, M., Yamamoto, R and Ebesu, R, 1998. Resistance of ACZA Treated Douglas-Fir Heartwood to the Formosan Subterranean Termite. American Wood Preservers’ Association.

Thornton, J.D., 1977. Potential toxicants for controlling soft rot in hardwoods II Laboratory tests using sawdust Material und Organismen 12 Bd 1997 Heft 3

UN, 2000. United Nations Environment Programme, Chemicals. Finding Alternatives to Persistant Organic Pollutants (POPs) for Termite Management. Prepared by members of the UNEP/FAO/Global IPM Facility Expert Group on Termite Biology and Management.

Table 5_3: Retention Levels for a copper-tebuconazole and non-boron containing formulation CBA –A

Target Copper kg / m3	Actual Copper kg / m3	Boric acid kg / m3	Tebuconazole kg / m3	Total CBA – A kg / m3
1.60	1.70	0.0	0.067	1.77
2.40	2.66	0.0	0.106	2.77
3.2	3.48	0.0	0.140	3.62

Section A5(1) Annex Point IIA V.5.1 – V.5.1.3	Efficacy Data (against wood-destroying Basidiomycete fungi and insects)	
	REFERENCE	**Official use only**
1. **Reference**	Price E.A.S and Watson, R.W., 1962. Review of water-borne preservatives. Rec. of 12th Annual Convention of the British Wood Preserving and Damp-proofing Association, London	
2. **Data protection**	No	
Data owner	Not applicable	
Criteria for data protection	No data protection claimed	
3. **Guideline study**	Not applicable - This report is based on a review of the published literature.	
4. **Deviations**	No Not applicable - This report is based on a review of the published literature.	
	5. **CONTENTS OF THE REVIEW**	
6. **Introduction**	The use of waterborne wood preservatives in vacuum/pressure pre-treatment was reviewed on order to present a summary of their development and to evaluate their present role. Note that this summary only includes information from the review that is directly relevant to the evaluation of the effectiveness of copper sulphate-containing 'uni-salt' wood preservatives against selected wood-destroying Basidiomycete fungi and insects using appropriate testing methods.	
7. **Literature data**	Data from the published literature on the 'initial toxicity' of copper sulphate to wood-destroying Basidiomycete fungi and insects (i.e. the toxic effect measured in laboratory experiments) were presented in summary form. The 'permanence of toxicity' obtained using copper sulphate 'uni-salt' wood preservatives (i.e. the persistence of toxicity over an extended period under field conditions) was also discussed.	
'Initial toxicity' to wood-destroying basidiomycete fungi	The 'initial toxicity' of copper sulphate to Basidiomycete fungi was investigated by means of a US soil block technique similar to the BS 838 wood block on agar test. 'Threshold values' (i.e. concentrations at which an inhibitory effect was seen, expressed as kg copper sulphate/m^3 treated wood) were reported for the following Basidiomycete species and wood samples: Pine blocks *Lentinus lepideus* (Brown rot). *Lenzites trabea* (Brown rot). *Poria monticola* (Brown rot). Oak blocks *Polyporus versicolor* (White rot) No additional experimental details were provided in the review.	

Section A5(1) Annex Point IIA V.5.1 – V.5.1.3	Efficacy Data (against wood-destroying Basidiomycete fungi and insects)	
'Initial toxicity' to wood-destroying insects	Data on the 'initial toxicity' of copper sulphate to the wooddestroying insects *Hylotrupes bajulus* and *Anobium punctatum* were reported. No additional experimental details were provided in the review.	
Permanence of toxicity	The high 'leachability' of unisalt preservatives was discussed and briefly demonstrated by means of literature data relating to the performance of a product containing copper sulphate in pole and post trials. No additional experimental details were provided in the review.	
8. Results and discussion		
'Initial toxicity' to wood-destroying basidiomycete fungi	The results obtained against selected Basidiomycete fungi using a soil-block technique are shown in **Table A5(1)-1**. Threshold values in the range 2.99 – 8.49 kg/m^3 were obtained against selected Basidiomycete fungi in pine blocks, whereas values obtained in oak blocks were 0.88 – 1.69 kg/m^3.	
'Initial toxicity' to wood-destroying insects	The results obtained for selected wood-destroying insects are shown in **Table A5(1)-2**. In summary, the toxic thresholds reported for copper sulphate against *Hylotrupes bajulus* and *Anobium punctatum* were 0.16% w/w and <0.25% w/w, respectively.	
Permanence of toxicity	The results obtained in pole and post field tests are shown in **Table A5(1)-3**. The results of this study are considered to represent a failure of wood preservation after an average of 4.3 years as a result of leaching losses of copper sulphate from treated timber when applied at an average retention of 72.1 kg/m^3.	
	9. APPLICANT'S SUMMARY AND CONCLUSION	
10. Summary of the review	A literature review of waterborne wood preservatives was carried out during which the performance of unisalt preservatives containing copper sulphate against wood-destroying Basidiomycete fungi and insects was discussed. It was reported that a soil block study, in which the 'Initial toxicity' of copper sulphate to selected brown rot Basidiomycete fungi was investigated, resulted in 'Threshold values' in the range 2.99 – 8.49 kg/m^3 in pine blocks, whereas those obtained with a white rot fungus in oak blocks were 0.88 – 1.69 kg/m^3. Detailed results are presented in **Table A5(1)-1**. 'Threshold values' were defined in the review as being those concentrations "required to inhibit growth". The methodology of this study was considered to be similar to the BS 838 wood block on agar test (which is in turn similar to the current EN 113 test). The 'Threshold values' for copper sulphate against the wood-destroying insects *Hylotrupes bajulus* and *Anobium punctatum* were reported to be 0.16% w/w and < 0.25% w/w, respectively (see **Table A5(1)-2**). The potential for loss of efficacy of unisalt wood preservatives as a	X1

Section A5(1)	Efficacy Data (against wood-destroying Basidiomycete fungi and insects)	
Annex Point IIA V.5.1 – V.5.1.3		
	result of leaching of the active ingredient from treated timber was also discussed in the review. This phenomenon was demonstrated by reference to a study in which copper sulphate applied at a retention rate of 72.1 kg/m^3 was shown to have an average life of 4.3 years (see **Table A5(1)-3**). Minimal experimental detail was provided for any of the studies for which results were reported. However, available information on the design of the studies is sufficient to conclude that Cu^{2+} showed efficacy against the organisms tested under conditions that are relevant to the proposed use of wood preservative products.	
11. Conclusion	Validity criteria can be considered as fulfilled, in that the data presented in this review provides sufficient confidence in the results to allow them to be used as part of a broader evaluation of the efficacy of Cu^{2+} against wood-destroying Basidiomycete fungi and insects.	
12. Reliability	2	
13. Deficiencies	Experimental details reported for the studies considered in this review were necessarily brief. A reliability of 2 is applied in view of this.	

	Evaluation by Competent Authorities
	Use separate "evaluation boxes" to provide transparency as to the comments and views submitted
	EVALUATION BY RAPPORTEUR MEMBER STATE
Date	June the 25th, 2009
Materials and Methods	*Adopt applicant's version*
Results and discussion	revised version Results provided by the applicant do not meet EN599 requirements. However, there are consistent data showing efficacy of copper against rot fungi (basidiomycetes) and wood borers.
Conclusion	revised version Data presented in this review provide sufficient confidence in the results to allow them to be used as part of a broader evaluation of the efficacy of Cu^{2+} against rot fungi Basidiomycetes and wood boring beetle
Reliability	Klimisch cotation: 2e
Acceptability	acceptable
Remarks	X1: the similarity between test techniques has not been demonstrated
	COMMENTS FROM
Date	*Give date of the comments submitted*
Materials and Methods	*Discuss additional relevant discrepancies referring to the (sub)heading numbers and to applicant's summary and conclusion.* *Discuss if deviating from view of rapporteur member state*
Results and discussion	*Discuss if deviating from view of rapporteur member state*

Section A5(1) Annex Point IIA V.5.1 – V.5.1.3	Efficacy Data (against wood-destroying Basidiomycete fungi and insects)	
Conclusion	*Discuss if deviating from view of rapporteur member state*	
Reliability	*Discuss if deviating from view of rapporteur member state*	
Acceptability	*Discuss if deviating from view of rapporteur member state*	

Table A_5(1)-1: Threshold Values of Unisalt Preservatives Against Basidiomycetes; Soil Block Method

Preservative	Threshold Value kg/m^3) against			
	Pine blocks (brown rot fungi)			Oak blocks (a white rot fungus)
	Lentinus lepideus	***Lenzites trabea***	***Poria monticola***	***Polyporus versicolor***
Copper Sulphat	2.99	4.81 – 6.70	4.89 – 8.49	0.88 – 1.69

Table A_5(1)-2: Threshold Values of Unisalt Preservatives Against *Hylotrupes bajulus* and *Anobium punctatum*

Preservative	Threshold Value (% w/w) against	
	Hylotrupes bajulus	***Anobium punctatum***
Copper Sulphate	0.16	≤ 0.25

Table A 5(1)-3: Performance of Unisalt Preservatives in Pole and Post Field Tests

Preservative	Average Retention (kg/m3)	Average Life (years)
Copper Sulphate	72.1	4.3

Section A5(2) Annex Point IIA V.5.1 – V.5.1.3	Efficacy Data (against wood-destroying Basidiomycetes)	
	REFERENCE	**Official use only**
14. Reference	Cockcroft, R., 1981. Wood Destroying Basidomycetes Vol. 1. IRG 81/1121.	
15. Data protection	No	
Data owner	Not applicable	
Criteria for data protection	No data protection claimed	
16. Guideline study	Not applicable - This report comprises a collection of monographs based on a survey of mycologists.	
17. Deviations	No Not applicable - This report comprises a collection of monographs based on a survey of mycologists.	
	18. CONTENTS OF THE REPORT	
19. Introduction	The report contains a series of monographs compiled on the basis of a questionnaire that was circulated globally to experts on wood-destroying fungi. The data returned were reviewed and collated into the monographs by International Research Group (IRG) expert working groups. One of the sections of the questionnaire concerned Resistance to Chemicals. Information gathered on the Toxic Limits (in kg/m^3) of a series of reference chemicals was subsequently presented in the corresponding section of each monograph. Information specifically related to copper sulphate is collated in this summary.	
20. Monograph toxic limit data	Suitable data on the toxic limits of copper sulphate obtained using unleached wood blocks were presented for the following wood-destroying Basidiomycete species: *Coniophora puteana* *Coriolus versicolor* *Lentinus lepideus* *Serpula lacrymans* No additional data on experimental methodology were provided in the report.	
21. Results and discussion	The available copper sulphate toxic limit data for each of the species listed in section 2.2 are presented in **Table A5(2)-1**. Toxic limit values for copper sulphate in the species considered ranged from 0.25 to 0.8 kg/m^3.	X
	22. APPLICANT'S SUMMARY AND CONCLUSION	
23. Summary of the review	A collection of monographs on common decay fungi that attack wood was compiled by the International research Group on Wood Preservation (IRG). The contents of the monographs were based on information returned in response to a questionnaire that had been circulated to expert mycologists around the world. One of the points raised in the questionnaire concerned the toxic limits of reference	

Section A5(2)	Efficacy Data (against wood-destroying Basidiomycetes)	
Annex Point IIA V.5.1 – V.5.1.3		
	chemicals in unleached wood blocks, one of which was copper sulphate. The species for which suitable copper sulphate toxic limit values were expressed, collected and subsequently reported in the monographs (and the related values as kg copper sulphate/m^3 wood) were as follows: *Coniophora puteana* (3.7 – 7.6 kg/m^3). *Coriolus versicolor* (0.25 – 0.40 kg/m^3). *Lentinus* lepideus (0.4 – 0.8 kg/m^3). *Serpula* lacrymans (3.0 – 3.8 kg/m^3). No additional experimental details were provided in the monographs.	
24. **Conclusion**	Validity criteria can be considered as fulfilled, in that the data presented in this report are sufficient to allow them to be used as part of a broader evaluation of the efficacy of Cu^{2+} against wood-destroying Basidiomycete fungi. Toxic limit values for copper sulphate in the species considered ranged from 0.25 to 0.8 kg/m^3.	X X
25. **Reliability**	2	
26. **Deficiencies**	Experimental details reported for the studies considered in this review were necessarily brief. A reliability of 2 is applied in view of this.	
	Evaluation by Competent Authorities	
	Use separate "evaluation boxes" to provide transparency as to the comments and views submitted	
	EVALUATION BY RAPPORTEUR MEMBER STATE	
Date	June,the 25th, 2009	
Materials and Methods	Adopt applicant's version	
Results and discussion	revised version. Toxic limit values for copper sulphate in the species considered ranged from 0.25 to 7.6 kg/m^3.	
Conclusion	revised version Validity criteria can be considered as fulfilled, in that the data presented in this report are sufficient to allow them to be used as part of a broader evaluation of the efficacy of Cu^{2+} against rot fungi Basidiomycetes. Toxic limit values for copper sulphate in the species considered ranged from 0.25 to 7.6 kg/m^3.	
Reliability	Klimisch cotation: 2g	
Acceptability	acceptable	
Remarks		
	COMMENTS FROM	
Date	*Give date of the comments submitted*	

Section A5(2) Annex Point IIA V.5.1 – V.5.1.3	Efficacy Data (against wood-destroying Basidiomycetes)	
Materials and Methods	*Discuss additional relevant discrepancies referring to the (sub)heading numbers and to applicant's summary and conclusion.* *Discuss if deviating from view of rapporteur member state*	
Results and discussion	*Discuss if deviating from view of rapporteur member state*	
Conclusion	*Discuss if deviating from view of rapporteur member state*	
Reliability	*Discuss if deviating from view of rapporteur member state*	
Acceptability	*Discuss if deviating from view of rapporteur member state*	

Table A_5(2)-1: Toxic Limit Values for Selected Bacidiomycetes exposed to Copper Sulphate in Unleached Wood Blocks.

Basidiomycete species	Toxic Limit Value (kg/m^3)
Coniophora puteana	3.7 – 7.6
Coriolus versicolor	0.25 – 0.40
Lentinus lepideus	0.4 – 0.8
Serpula lacrymans	3.0 – 3.8

Section A5(3) Annex Point IIA V.5.1 – V.5.1.3	Efficacy Data (copper tolerance in wood-destroying fungi)	
	1 REFERENCE	Official use only
1.1 Reference	Pohleven, F., Miha, H., Sam, A & Jaka, B., 2002. Tolerance of wood decay fungi to commercial copper based wood preservatives. IRG Document No. 02-30291.	
1.2 Data protection	No.	
1.2.1 Data owner	Not applicable.	
1.2.3 Criteria for data protection	No data protection claimed.	
	2 GUIDELINES AND QUALITY ASSURANCE	
2.1 Guideline study	A study was carried out to determine whether Cu-tolerance occurs only with CCB, CCA or copper sulphate treated wood, or whether tolerant fungi also pose a threat to wood treated with oil-borne copper naphthenate and copper amine based preservatives. Norway spruce samples were impregnated with commercial Cu-based preservatives and exposed to selected Cu-tolerant strains. This part of the study was carried out in accordance with standard laboratory test guideline SIST EN 113. The results were compared with those from a screening test, in order to determine the suitability of the screening test as a means of predicting the Cu tolerance of fungi.	
2.2 GLP	No. GLP is not applicable to studies of this type.	
2.3 Deviations	None.	
	3 MATERIALS AND METHODS	
3.1 Test material		
3.1.1 Fungal Isolates	The fungal isolates used in this study are listed in **Table A5(3)-1**.	
3.1.2 Preservative solutions	The preservative solutions used in this study are listed in **Table A5(3)-2**.	
3.2 Test method		
3.2.1 Copper tolerance agar screening test	To 10 ml of cooling sterilized potato dextrose agar, calculated volumes of diluted Cu-based preservative solutions were added, to achieve final Cu concentrations of 5×10^{-4}, 1×10^{-3}, 5×10^{-3}, 1×10^{-2}, 2.5×10^{-2} mol/l. The screening test was not performed with copper naphthenate, as Cu in this form is not water-soluble. For potassium dichromate, the concentration of Cr added to the medium was equal to that used for the CCB preservative. To ensure reduction of Cr in the medium, one week of "fixation" was allowed prior to inoculation with fungi. Media without preservative solution were used as control. Five tubes with the medium were prepared for each concentration and preservative. The solidified medium was inoculated with pieces of mycelium of wood decay fungi (diameter 0.7 cm) and placed in a growth chamber at 25 °C and 75 % RH. Fungal growth was estimated visually and compared with growth of controls. Fungicidal activity, estimated in terms of growth retardation, was assessed as follows: 1 - Normal growth, no retardation (control) 2 - Slightly visible signs of retardation 3 - Significant retardation	

	4 - Retardation is very strong 5 - No fungal growth	
3.2.2 Standard laboratory test EN 113	Norway spruce sapwood (*Picea abies*) samples (1.5 × 2.5 × 5 cm, longitudinal direction) were vacuum-impregnated with the preservatives listed in **Table A5(3)-2** according to EN 113. The resulting solution uptake was about 87 % of the oven-dry wood mass. Samples were then conditioned for four weeks (two weeks in closed chambers, the third week in half closed and the fourth week in open chambers). Samples were then oven dried, weighed and steam sterilised. Jars with PDA medium were inoculated with small pieces of fungal mycelium, after which samples (one each of treated and untreated) were placed on a plastic net in each inoculated jar. The samples were incubated in a growth chamber at 25 °C, RH = 75 % for 16 weeks, after which fungi mycelia were removed and sample mass losses determined. The experiment was replicated five times.	
3.2.3 Electron paramagnetic resonance spectroscopy (EPR)	ESR measurements were performed on nutrient medium containing potassium dichromate or CCB salts. Capillary tubes were filled with nutrient medium and inserted into a resonator. EPR measurements were performed at room temp. in a Bruker ESP-300 X-band spectrometer. (Microwave Frequency = 9.62 GHz, Microwave Power = 20 mW, Modulation Frequency = 100 kHz, Modulation Amplitude = 0.1 mT)	
	4 RESULTS AND DISCUSSION	
4.1 Screening test		
4.1.1 Copper (II) sulphate	No growth retardation was seen at 5×10^{-4} mol/l in any of the fungi tested (see **Table A5(3)-3**). Growth of the Cu-sensitive strain *G. trabeum* was slightly retarded on nutrient medium containing 1×10^{-3} mol/l copper sulphate. This concentration did not affect growth of the tolerant strains. Significant retardation was observed in all species at the highest concentration of Cu in the agar media (2.5×10^{-2} mol/l). The lowest retardation at the highest concentration was observed for fungi Pv2 and Yf. Among the tolerant strains, only strain Av5 did not grow on the medium containing the highest concentration. Variation of Cu tolerance within different strains was attributed to differing rates of oxalic acid production by different fungal strains. Pale blue crystals were seen on the surface of the nutrient medium containing the highest Cu concentration of Cu-tolerant strains. These were assumed to be copper oxalate crystals, as tolerant fungi produce copious amounts of oxalic acid that reacts with Cu to produce this non-toxic, insoluble salt.	
4.1.2 Copper amine preservative	The minimum Cu concentration of 5×10^{-4} mol/l affected the growth rate of some Cu-tolerant fungi (Av5, Yf, Pm2), as well as Cu-sensitive *G. trabeum*. The highest Cu-tolerance was exhibited by the tolerant strain Pv2, followed by the sensitive strain *G. trabeum*. However, growth of all the tested fungi was completely retarded at 1.0×10^{-2} mol/l (see **Table A5(3)-4**). Growth retardation was attributed to the fact that insoluble copper oxalate could not be formed in the presence of amine. Consequently, the soluble copper present in the medium was toxic to the fungi. The Cu-olerant strain Pv2, which exhibited the highest Cu-tolerance of the other Cu compounds tested, was also the most tolerant of copper/amine preservative.	
4.1.3 Chromated copper	Fungi Pm2 and *G. trabeum*, which showed the lowest tolerance of copper sulphate, exhibited the highest resistance to CCB. Fungal	

Section A5(3)	Efficacy Data (copper tolerance in wood-destroying	
Annex Point IIA V.5.1 – V.5.1.3	fungi)	
borate	strains that showed the highest tolerance of copper sulphate (Pv2, Pv4, Yf and Av4), stopped growing at a relatively low Cu concentration of (1.0×10^{-3} mol/l) (see **Table A5(3)-5**). The presence of Cr did not have any toxic effect on strains that did not show significant tolerance to copper sulphate, since the level of growth retardation was almost the same in each case (see **Table A5(3)-3** and **Table A5(3)-5**). In order to determine the role of Cr, screening tests were performed on nutrient medium containing potassium dichromate (see section 4.1.4).	
4.1.4 Potassium dichromate	Fungal strains, that were most tolerant to copper sulphate (Pv2, Pv4, Yf and Av4), stopped growing at even the lowest concentration of Cr in the nutrient medium (5.0×10^{-4} mol/l). The lowest retardation was seen for the Cu-sensitive strains Pm2 and *G. trabeum*. (see **Table A5(3)-6**). EPR measurements of the nutrient media confirmed that Cr (VI) was not reduced to Cr (III) in the nutrient medium of this system, whereas it had been reduced in the CCB system in the presence of Cu and B. The high toxicity of Cr in the nutrient medium was therefore attributed to incomplete reduction of toxic Cr (VI) in the absence of Cu.	
4.2 Standard laboratory test (EN 113)	Mass losses in the control samples indicated that all fungal strains were active (**Table A5(3)-7**). Impregnation with copper naphthenate did not result in decreased decay. Mass losses of copper naphthenate-treated samples exposed to Cu-tolerant strains Pv4 and Yf were even higher than losses in control specimens, indicating that copper accelerated fungal decay. Slightly smaller, but still significant mass losses, were seen in copper naphthanate-treated samples exposed to the Cu-sensitive fungus *G. trabeum*. It was concluded that both Cu-tolerant and Cu-sensitive fungi are able to decompose copper naphthenate- treated wood to the same extent as the control samples. Copper sulphate did not offer effective protection against Cu-tolerant fungi, but it did reduced mass losses caused by *G. trabeum*. As for the copper naphthenate-treated specimens, copper sulphate resulted in even higher mass losses of treated samples than in control samples exposed to the Cu-tolerant fungi Pv2 and Pv4 (**Table A5(3)**-7). These two fungi were the most tolerant in the screening test. This confirmed results of the screening test, that copper sulphate was not effective against Cutolerant strains. This finding was attributed to oxalic acid production by Cu-tolerant fungi, leading to the formation of insoluble copper oxalate. In the presence of amine, formation of insoluble copper oxalate is not possible and Cu remains in soluble, toxic form. This was seen from mass losses of samples impregnated with copper amine preservative and exposed to Cu-tolerant organisms (**Table A5(3)-7**). Comparable mass losses were seen in the copper amine and copper sulphate-treated samples exposed to Cu-sensitive *G. trabeum*. These results argee with those of the screening test, in which comparable maximum toxic concentrations were obtained against *G. trabeum* (see **Table A5(3)-7**). Treatment of samples with CCB resulted in the lowest mass losses of the samples exposed to the Cu-tolerant fungi as well at to the Cu-sensitive fungus. The most tolerant fungal strain Pv4 resulted in a loss of only 1.8 % of the sample's initial mass. This indicates that CCB treated wood was protected against Cu-tolerant organisms. This result agrees with the screening test, in which CCB was the most toxic preservative solution.	
4.3 Conclusions	Cu-tolerant fungi were able to decompose wood samples treated with	

Section A5(3) Annex Point IIA V.5.1 – V.5.1.3	Efficacy Data (copper tolerance in wood-destroying fungi)	
	copper sulphate or copper naphthenate. The highest copper tolerances were shown by strains Pv2 and Pv4. Although the Cu-sensitive fungus *G. trabeum* was unable to decompose Cu-treated samples, it decomposed copper naphthenate-treated samples. Even the most Cu-tolerant fungi could not decompose wood preserved with CCB or copper amine preservative. Amine in copper aminetreated wood prevented formation of copper oxalate, keeping Cu in a soluble, toxic form and preventing decay. Results of the screening test correlated well with mass losses in the standard laboratory test. The Cu-sensitive fungus *G. trabeum* stopped growing when the concentration of Cu in the nutrient medium reached 5.0×10^{-3} mol/l. Mass losses of samples treated with various waterborne copper-based preservatives and exposed to *G. trabeum* varied between 3.3 and 1.4 %. Fungal strains that exhibited the highest Cu tolerance in screening tests also caused the highest mass losses in the standard laboratory tests. It was concluded on the basis of these results that screening tests can be used to determine Cu-tolerance of fungi.	
	5 APPLICANT'S SUMMARY AND CONCLUSION	
5.1 Materials and methods	A study was carried out to investigate tolerance of selected wood-destroying fungi (seven Cu-tolerant isolates and the Cu-sensitive fungus *Gloeophyllum trabeum*) to three commercial Cu-based preservatives (a copper amine preservative; a chromated copper borate (CCB) preservative and a copper naththenate preservative), copper (II) sulphate and potassium dichromate. The study included a screening test performed on 3.9% potato dextrose agar (PDA) containing solutions of each copper-based test preparation (except the insoluble copper naphthanate product) at Cu concentrations of 5×10^{-4}, 1×10^{-3}, 5×10^{-3}, 1×10^{-2} and 2.5×10^{-2} mol/l). The solidified medium was inoculated with pieces of fungal mycelium and incubated at 25 °C. Subsequent fungal growth was estimated visually and compared with growth of controls. Five PDA tubes with the medium were prepared for each concentration and preservative. In order to determine the role of Cr in CCB, screening tests were performed on nutrient medium containing potassium dichromate. A standard laboratory test was also performed in which Norway spruce sapwood samples were vacuum-impregnated with each of the Cu-based preservatives and copper sulphate according to EN 113, inoculated with small pieces of fungal mycelium and incubated at 25 °C for 16 weeks. Mass loss from the inoculated wood blocks was noted. Un-inoculated controls were included. The experiment was replicated five times.	
5.2 Results and discussion	Results obtained on wood samples showed that various fungal isolates exhibited different levels of Cu tolerance depending on the Cu-based biocide (see **Table A5(3)-7**). Cu-tolerant fungi were able to decompose wood samples treated with copper sulphate or copper naphthenate. This ability is attributed to the production of large amounts of oxalic acid by Cu-tolerant fungi, which reacts with Cu to form insoluble, low-toxicity copper oxalate. However, even the most Cu-tolerant fungi could not significantly decompose wood preserved with CCB or copper amine preservative. It was considered that amine in copper amine-treated wood prevented formation of copper oxalate, keeping Cu in a soluble, toxic form and	

Section A5(3)	Efficacy Data (copper tolerance in wood-destroying	
Annex Point IIA V.5.1 – V.5.1.3	**fungi)**	
	thereby preventing decay. Although the Cu-sensitive fungus *G. trabeum* was unable to decompose samples treated with copper amine or CCB preservative, it decomposed copper naphthenate-treated samples. Mass losses of samples treated with the various waterborne copper-based preservatives and exposed to *G. trabeum* varied between 3.3 and 1.4 %. Growth inhibition results seen in the screening test (**Table A5(3)-3** to **Table A5(3)-5** correlated well with mass losses in the standard laboratory test. The Cu-sensitive fungus *G. trabeum* stopped growing when the concentration of Cu in the nutrient medium reached 5.0 X 10^{-3} mol/l. Fungal strains that exhibited the highest Cu tolerance in screening tests also caused the highest mass losses in the standard laboratory tests. It was confirmed in the screening test that Cr present in appropriately fixed CCB was present in the reduced (Cr(III)) form, whereas reduction of toxic Cr (VI) in the nutrient medium containing potassium dichromate was incomplete. It was concluded on the basis of these findings that screening tests may be used to determine the Cu tolerance of wood-decay fungi.	
5.3 Conclusion	The phenomenon of copper tolerance has been adequately demonstrated and is attributable to the production of oxalic acid by relevant fungi, which reacts with Cu^{2+} ions to form insoluble copper oxalate. The addition of supplementary biocides or use of very high copper loadings will overcome fungal tolerance. Validity criteria can be considered as fulfilled, in that the data presented in this report provides sufficient confidence in the results to allow them to be used as part of a broader evaluation of the efficacy of Cu^{2+} against wood-destroying fungi.	
5.3.1 Reliability	2	
5.3.2 Deficiencies	A number of technical details alluded to in other protocols or reports were referred to, but not reproduced here. However this did not detract from the reliability of the data derived or the robustness of the conclusions that were drawn. A reliability of 2 has been assigned on this basis.	
	Evaluation by Competent Authorities	
	Use separate "evaluation boxes" to provide transparency as to the comments and views submitted	
	EVALUATION BY RAPPORTEUR MEMBER STATE	
Date	June the 25th, 2009	
Materials and Methods	Adopt applicant's version	
Results and discussion	Adopt applicant's version	
Conclusion	Adopt applicant's version	
Reliability	Klimisch cotation: 2g	
Acceptability	acceptable	
Remarks	This report provides efficacy data on copper tolerant fungus	

Section A5(3) Annex Point IIA V.5.1 – V.5.1.3	Efficacy Data (copper tolerance in wood-destroying fungi)	
	COMMENTS FROM	
Date	*Give date of the comments submitted*	
Materials and Methods	*Discuss additional relevant discrepancies referring to the (sub)heading numbers and to applicant's summary and conclusion.* *Discuss if deviating from view of rapporteur member state*	
Results and discussion	*Discuss if deviating from view of rapporteur member state*	
Conclusion	*Discuss if deviating from view of rapporteur member state*	
Reliability	*Discuss if deviating from view of rapporteur member state*	
Acceptability	*Discuss if deviating from view of rapporteur member state*	

Antrodia vaillantii	*Av* 4	University of Hamburg (DFPG 6911 New Zealand)
Antrodia vaillantii	*Av* 5	University of Hamburg (HUM Germany)
Antrodia vaillantii	*Pv* 2	University of Ljubljana (ZIM L037 Raspor *et al.*, 1995)
Antrodia vaillantii	*Pv* 4	BAM 190
Poria monticola	*Pm*2	BAM 102
Leucogyrophana pinastri	*Yf*	Buckinghamshire Chilterns University College UK

Commercial name	Abbreviation	Composition	Producer
Kuproflorin	CuA	Cu, F, amine (c_{Cu} = 1.22 %)	Regeneracija
Silvanol G	CCB	Cu, Cr, B (c_{Cu} = 0.43 %, c_{Cr} = 0.66 %)	Silaprodukt

Cu(II) concentration [mol/l]	Fungal strain						
	Pv2	Pv4	Av5	Yf	Av4	Pm2	Gt
	Visually determined marks						
5.0×10^{-4}	1	1	1	1	1	1	1
1.0×10^{-3}	1	1	1	1	1	1	2
5.0×10^{-3}	1	1.5	1	1	1	1	5
1.0×10^{-2}	1.5	2	2	2	1.5	2	5
2.5×10^{-2}	3	4	5	3	3.5	4	5

Cu(II) concentration [mol/l]	Fungal strain						
	Pv2	Pv4	Av5	Yf	Av4	Pm2	Gt
	Visually determined marks						
5.0×10^{-4}	1	1	2	2	1	3	2
1.0×10^{-3}	2	2	3.5	3	2	4	3
5.0×10^{-3}	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Cu(II) concentration [mol/l]	Fungal strain						
	Pv2	Pv4	Av5	Yf	Av4	Pm2	Gt
	Visually determined marks						
5.0×10^{-4}	1	2	1	1	2	1	1
1.0×10^{-3}	5	5	4.5	5	5	3	2
5.0×10^{-3}	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Cr concentration [mol/l]	Equivalent Cu(II) conce. [mol/l]	Fungal strain						
		Pv2	Pv4	Av5	Yf	Av4	Pm2	Gt
		Visually determined marks						
7.7×10^{-4}	5.0×10^{-4}	4.5	5	5	4	4.5	2	2
1.5×10^{-3}	1.0×10^{-3}	4.5	5	5	4.5	5	4.5	4
7.7×10^{-3}	5.0×10^{-3}	4.9	5	5	5	5	5	5
1.5×10^{-2}	1.0×10^{-2}	5	5	5	5	5	5	5
3.8×10^{-2}	2.5×10-2	5	5	5	5	5	5	5

Table B5(3)-7. Mass losses of spruce wood samples treated with different copper-based preservatives* exposed to different brown rot fungi for 16 weeks.

CuA	3.7	3.2	2.9	2.8	2.9	3.3	2.5
CCB	1.8	1.4	1.1	1.2	1.2	0.6	1.4
CuN	22.8	23.9	21.4	24.2	18.6	12.8	12.9
CuS	27.6	24.9	17.5	16.4	12.9	12.3	3.3
Control	24.6	21.6	23.8	19.3	19.8	37.9	43.5

CuA = Copper amine preservative; CCB = Chromated copper borate; CuN = Copper naphthenate; CuS = Copper sulphate.

Section A5(4) Annex Point IIA V.5.1 – V.5.1.3	Efficacy Data (efficacy against soft rotting fungi)	
	1 REFERENCE	Official use only
1.1 Reference	Greaves, H., 1977. Potential toxicants for controlling soft rot in hardwoods 1. Laboratory screening tests using a filter paper technique Material und Organismen 12 Bd 1997 Heft.	
1.2 Data protection	No.	
1.2.1 Data owner	Not applicable.	
1.2.3 Criteria for data protection	No data protection claimed.	
	2 GUIDELINES AND QUALITY ASSURANCE	
2.1 Guideline study	No. This report relates to non-guideline work carried out to investigate new toxicants for application either as diffusing remedial treatments or as initial treatments for hardwoods in ground contact.	
2.2 GLP	No. GLP is not applicable to studies of this type.	
2.3 Deviations	None.	
	3 MATERIALS AND METHODS	
3.1 Test material		
3.1.1 Fungal Isolates	The test fungi were *Chaetomium globosum* Kunze, *Cephalosporium acremonium* Corda and a 'mixed inoculum' of finely ground soft rotted wood obtained from CCA-treated transmission poles.	
3.1.2 Preservative solutions	A number of organic and inorganic candidate chemicals were screened at a range of concentrations. Only data relating directly to the evaluation of copper sulphate ($CuSO_4$) as a unisalt application are presented in this summary. The concentrations of copper sulphate screened are presented in **Table A5(4)-1**.	
3.2 Test method	The basic screening technique involved the use of a cellulose matrix uniformly impregnated with the candidate chemical and evenly inoculated with either pure cultures of soft-rotting microfungi, or a mixed population, including soft-rotters, derived from a natural source (see section 3.1.1). Standard white Whatman filter papers (70 mm diameter), placed on tap water agar containing mineral salt additives, were used as the cellulose matrix. The concentrations are expressed as nominal percentage (w/v) treating solutions and also as mg of active ingredient retained by each filter paper. Weight of active elements was also expressed on an atomic basis. The average weight of the filter paper was 0.70 g, while the average retention of the paper was 1.20 g treating solution. The filter papers were impregnated by immersion in the test solution for a standard time, followed by drying overnight in empty, sterile Petri dishes (control filter papers were not immersed in test solutions). A sterile water suspension of the test fungi was prepared and the dry impregnated filter papers were momentarily dipped in the suspensions, providing a uniform inoculation. The papers were then transferred to the surface of agar plates containing 20 ml medium (see **Table A5(4)-2**	

Section A5(4)	Efficacy Data (efficacy against soft rotting fungi)	
Annex Point IIA V.5.1 – V.5.1.3		
	for growth medium composition). These were incubated at 25°C and examined for microbial development at regular intervals.	
	4 RESULTS AND DISCUSSION	
4.1 Screening test	Microbial growth responses to copper sulphate and the reference chemical are summarised in **Table A5(4)-3**. In the case of the pure cultures, the assessment of the amount of growth was readily obtained and very clear-cut, but with the mixed inoculum the microflora were affected in different ways, making assessment more difficult. For example, although copper sulphate gradually eliminated the fungal flora, it did not prevent bacterial growth to the same extent. The finely ground wood inoculum produced a good representative mocroflora; fungi included the genera *Penicillium*, *Aspergillus*, *Trichoderma*, *Fusarium*, *Chaetomium*, *Pestalotia*, *Paecilomyces*, *Cladosporium* and a number of additional dematiaceous types. Known soft-rotting microfungi were therefore well represented. Vegetative mycelium degeneration was observed when *Chaetomium globosum* was incubated in the presence of 5% w/v copper sulphate (growth at this concentration was assessed as 'moderate', whereas growth seen at 3% w/v copper sulphate was 'excellent'). 'Poor' growth of *Cephalosporium acremonium* was seen at the lowest copper sulphate concentration tested (0.9% w/v). 'Excellent' growth of mixed inoculum fungi in the presence of 3% (w/v) copper sulphate was significantly reduced to 'moderate' growth in the presence of 5% (w/v) copper sulphate. Growth on control filter paper was always classified as 'good' or 'excellent'.	
4.2 Conclusions	'Excellent' fungal growth of the single species *Chaetomium globosum* and in a mixed inoculum in the presence of 3% w/v copper sulphate was reduced to 'moderate' at 5% w/v copper sulphate. Poor growth of *Cephalosporium acremonium* was seen at the lowest copper sulphate concentration tested (0.9% w/v). It was concluded that the filter paper agar technique is a satisfactory means for rapid screening of candidate chemicals.	

Section A5(4) Annex Point IIA V.5.1 – V.5.1.3	Efficacy Data (efficacy against soft rotting fungi)	
	5 APPLICANT'S SUMMARY AND CONCLUSION	
5.1 Materials and methods	A study was conducted to screen a number of candidate chemicals, including copper sulphate solution at concentrations of 0.9, 3, 5 and 7% w/v , for their efficacy in controlling the growth of *Chaetomium globosum*, *Cephalosporium acremonium* and a 'mixed inoculum' of finely ground soft rotted wood obtained from CCA-treated transmission poles. Standard white Whatman filter papers were immersed in the test solutions and dried overnight (control filter papers were not immersed in test solutions). The dried filter papers were then dipped in a sterile water suspension of the test fungi, transferred to the surface of agar plates containing growth medium and incubated at 25°C. Filter papers were then examined for microbial development at regular intervals and growth was categorised as 'excellent', 'good', 'moderate', 'poor' or 'no growth'.	
5.2 Results and discussion	Vegetative mycelium degeneration was observed when *Chaetomium globosum* was incubated in the presence of 5% w/v copper sulphate (growth at this concentration was assessed as 'moderate', whereas growth seen at 3% w/v copper sulphate was 'excellent'). 'Poor' growth of *Cephalosporium acremonium* was seen at the lowest copper sulphate concentration tested (0.9% w/v). 'Excellent' growth of mixed inoculum fungi in the presence of 3% (w/v) copper sulphate was significantly reduced to 'moderate' growth in the presence of 5% (w/v) copper sulphate. Growth on control filter paper was always classified as 'good' or 'excellent'.	
5.3 Conclusion	'Exellent' fungal growth of the single species *Chaetomium globosum* and in a mixed inoculum in the presence of 3% w/v copper sulphate was reduced to 'moderate' at 5% w/v copper sulphate. Poor growth of *Cephalosporium acremonium* was seen at the lowest copper sulphate concentration tested (0.9% w/v). Validity criteria can be considered as fulfilled, in that the data presented in this report provides sufficient confidence in the results to allow them to be used as part of a broader evaluation of the efficacy of Cu^{2+} against wood-destroying fungi.	
5.3.1 Reliability	2	
5.3.2 Deficiencies	A number of minor technical details were omitted from the report. However this did not detract from the reliability of the data derived or the robustness of the conclusions that were drawn. A reliability of 2 has been assigned on this basis.	
	Evaluation by Competent Authorities	
	Use separate "evaluation boxes" to provide transparency as to the comments and views submitted	
	EVALUATION BY RAPPORTEUR MEMBER STATE	
Date	June the 25th, 2009	

Section A5(4)	Efficacy Data (efficacy against soft rotting fungi)	
Annex Point IIA V.5.1 – V.5.1.3		

Materials and Methods	Adopt applicant's version
Results and discussion	Adopt applicant's version
Conclusion	revised version Validity criteria can be considered as fulfilled, in that the data presented in this report provides sufficient confidence in the results to allow them to be used as part of a broader evaluation of the efficacy of Cu^{2+} against soft rot fungi.
Reliability	Klimisch cotation: 2e
Acceptability	acceptable
Remarks	
	COMMENTS FROM
Date	*Give date of the comments submitted*
Materials and Methods	*Discuss additional relevant discrepancies referring to the (sub)heading numbers and to applicant's summary and conclusion.* *Discuss if deviating from view of rapporteur member state*
Results and discussion	*Discuss if deviating from view of rapporteur member state*
Conclusion	*Discuss if deviating from view of rapporteur member state*
Reliability	*Discuss if deviating from view of rapporteur member state*
Acceptability	*Discuss if deviating from view of rapporteur member state*

Table B5(4)-1. Concentrations of Copper Sulphate ($CuSO_4$) Tested

Nominal a) (% w/v)				Concentrations Tested								Active Element
				As Active Ingredients b)								
				By weight (mg)				By weight (mg atoms)				
0.9	3	5	7	4.32	14.40	24.00	33.60	0.068	0.227	0.378	0.529	Cu

Table B5(4)-2 Composition of Growth Medium

Component	Concentration (%)
Ammonium nitrate	**0.6**
di-potassium hydrogen phosphate	**0.4**
Mono-potassium di-hydrogen phosphate	**0.5**
Hydrated magnesium sulphate	**0.4**
Thiamine hydrochloride	**0.0002**
Agar	**1.5**
Tap water	**To volume**

Table B5(4)-3. Summary of growth responses to Copper Sulphate

Nominal Concentration (% w/v)				Amount of growth a)											
				Chaetomium globosum				*Cephalosporium acremonium*				Mixed inoculum			
0.9	3	5	7	4	4	2	2	1	NT	NT	NT	4	4	2	2

a) 0 No growth
1 Poor growth
2 Moderate growth
3 Good growth
4 Excellent growth
NT Not tested

Growth on control filter paper was always in categories 3 to 4

Section A5(5) Annex Point IIA V.5.1 – V.5.1.3	**Efficacy Data (efficacy against soft rotting fungi)**	
	1 REFERENCE	Official use only
1.1 Reference	Thornton, J.D., 1977. Potential toxicants for controlling soft rot in hardwoods II Laboratory tests using sawdust Material und Organismen 12 Bd 1997 Heft 3	
1.2 Data protection	No.	
1.2.1 Data owner	Not applicable.	
1.2.3 Criteria for data protection	No data protection claimed.	
	2 GUIDELINES AND QUALITY ASSURANCE	
2.1 Guideline study	No. This report relates to non-guideline work carried out to assess the efficacy of preservatives using a rapid visual estimation of fungal growth on treated sawdust, as well as by losses in weight due to decay. Only information relating directly to copper sulphate was included in this summary.	
2.2 GLP	No. GLP is not applicable to studies of this type.	
2.3 Deviations	None.	
	3 MATERIALS AND METHODS	
3.1 Test materials		
3.1.1 Preservative materials	Copper sulphate dissolved in distilled water.	
3.1.2 Test organisms	A 5 mm diameter disc taken from the growing edge of a colony of *Gloeophyllum trabeum* growing on malt agar, or 5 mg (dry weight) finely ground, soft-rotted wood obtained from CCA-treated transmission poles, was added to each dish. The former inoculum was placed centrally and the latter was spread as evenly as possible over the sawdust surface as practicable. *G. trabeum*-inoculated dishes were incubated at 22 - 25°C, whereas those incubated with soft-rot micro-organisms were incubated at 27°C.	
3.2 Test method	400 mg samples of oven-dried sawdust from three spotted gum trees (*Eucalyptus maculata*) were placed into six 24 mm diameter polyethylene dishes, i.e. two dishes per tree. The six dishes were arranged in a single Petri dish and autoclaved for 20 minutes at 103.42 kPa. Copper sulphate solutions were prepared in a dilution. Copper sulphate treatment concentrations in the sawdust were 0.099, 0.48, 2.4 and 12% w/w. The volume of diluted preservative added to the sawdust in each dish resulted in a final moisture content of 300%. $(NH4)2SO4$ was included as the sole nutrient addition at a concentration in the sawdust of 0.1% w/w. Duplicates of each treatment, including treated and water-treated controls , were prepared. Of these, one set was inoculated while the other was kept sterile. All Petri dishes were incubated in closed containers, moistened to ensure high humidity. Determinations of preservative effectiveness were made after 11 days	

	and again after 12 weeks, by scoring for the amount of fungal growth visible on the sawdust surface. Quantitative determinations were made following oven drying to constant weight at 70°C at the end of 12 weeks incubation.	
	4 RESULTS AND DISCUSSION	
4.1 Surface colonisation of sawdust	Qualitative values of surface growth of soft rot organisms or *G. trabeum* on spotted gum sapwood are shown in **Table A5(5)-1**. It was considered that, when compared to *G. trabeum*, at least some of the organisms in the soft rot experiment showed a degree of copper tolerance. It was noted that the only fungal colonies present at the highest copper concentration were those of a *Fusarium* species.	
4.2 Quantitative decay data	Values of weight loss from sawdusted sapwood of spotted gum twelve weeks after inoculation with soft rot organisms or *G. trabeum* are shown in **Table A5(5)-2**. These values are following correction for changes in weight of the uninoculated, sterile controls. There was good agreement between weight loss and surface growth after 12 weeks (see **Table A5(5)-1**). It was considered on this basis that visible growth gave a good indication as to the amount of decay occurring.	
	5 APPLICANT'S SUMMARY AND CONCLUSION	
5.1 Materials and methods	A study was carried out to assess the efficacy of preservatives using a rapid visual estimation of fungal growth on treated sawdust, as well as by losses in weight due to decay. Only information relating directly to copper sulphate was included in this summary. Samples of oven-dried sawdust for use in the study were obtained from three spotted gum trees (*Eucalyptus maculata*). Duplicate sawdust samples from each tree were treated with each test fungus at each of the copper sulphate concentrations used. Untreated (water-only) controls were also set up. The fungi evaluated were the brown rot *Gloeophyllum trabeum* and those present in a sample of soft-rotted wood obtained from CCA-treated transmission poles. Copper sulphate was diluted in distilled water and added to sawdust to give concentrations of 0.099, 0.48, 2.4 and 12% w/w in the sawdust and a moisture content of 300%. $(NH4)2SO4$ was added as a nutrient at a concentration in the sawdust of 0.1% w/w. *G. trabeum*-inoculated dishes were incubated at 22 - 25°C, whereas those incubated with soft-rot micro-organisms were incubated at 27°C. Determinations of preservative effectiveness were made after 11 days and again after 12 weeks, by scoring for the amount of fungal growth visible on the sawdust surface. Quantitative determinations were made following oven drying to constant weight at 70°C at the end of 12 weeks incubation.	
5.2 Results and discussion	Qualitative values of surface growth of soft rot organisms or *G. trabeum* on spotted gum sapwood are shown in **Table A5(5)-1**. After 12 weeks, it was found that there was 'excellent' soft-rot growth at a copper sulphate concentration of 2.4% w/w, compared with only 'moderate' growth at 12% w/w. The only fungal colonies present at the highest copper concentration were those of a *Fusarium* species. After	

Section A5(5)	Efficacy Data (efficacy against soft rotting fungi)	
Annex Point IIA V.5.1 – V.5.1.3		
	the same period, there was found to be only 'moderate' growth of *G. trabeum* at a copper sulphate concentrations of 0.48% and no growth at 2.4%. Weight loss seen in sawdust samples after 12 weeks are shown in **Table A5(5)-2**. These values were corrected for changes in weight of the uninoculated, sterile controls. There was good agreement between weight loss and surface growth after 12 weeks (see **Table A5(5)-1**). It was considered on this basis that visible growth gave a good indication as to the amount of decay occurring.	
5.3 Conclusion	After an incubation period of 12 weeks, soft rot fungi showed only 'moderate' growth on hardwood sawdust containing copper sulphate at a concentration of 12% w/w, compared with 'excellent' growth at a concentration of 2.4% w/w. Inhibition of fungal growth by copper sulphate was therefore evident in this test. Validity criteria can be considered as fulfilled, in that the data presented in this report provides sufficient confidence in the results to allow them to be used as part of a broader evaluation of the efficacy of Cu^{2+} against wood-destroying fungi.	x
5.3.1 Reliability	2	
5.3.2 Deficiencies	A number of technical and reporting details were omitted from the report. However this did not detract from the reliability of the data derived or the robustness of the conclusions that were drawn. A reliability of 2 has been assigned on this basis.	
	Evaluation by Competent Authorities	
	Use separate "evaluation boxes" to provide transparency as to the comments and views submitted	
	EVALUATION BY RAPPORTEUR MEMBER STATE	
Date	June the 25th,2009	
Materials and Methods	Adopt applicant's version	
Results and discussion	Adopt applicant's version	
Conclusion	revised version Validity criteria can be considered as fulfilled, in that the data presented in this report provides sufficient confidence in the results to allow them to be used as part of a broader evaluation of the efficacy of Cu^{2+} against *G. trabeum* (rot fungi)	
Reliability	Klimisch cotation: 2e	
Acceptability	acceptable	
Remarks	This report does not provide data showing sufficient efficacy of cu++ on soft rot fungi	
	COMMENTS FROM	
Date	*Give date of the comments submitted*	
Materials and Methods	*Discuss additional relevant discrepancies referring to the (sub)heading numbers and to applicant's summary and conclusion.*	

Section A5(5) Annex Point IIA V.5.1 – V.5.1.3	Efficacy Data (efficacy against soft rotting fungi)	
	Discuss if deviating from view of rapporteur member state	
Results and discussion	*Discuss if deviating from view of rapporteur member state*	
Conclusion	*Discuss if deviating from view of rapporteur member state*	
Reliability	*Discuss if deviating from view of rapporteur member state*	
Acceptability	*Discuss if deviating from view of rapporteur member state*	

Table B5(5)-1. Surface colonisation of sawdust of spotted gum treated with copper sulphate after 11 days (values after 12 weeks are in parentheses).

Inoculum	Formulation	Amount of growth[a)]			
		% concentration in wood			
		12	2.4	0.48	0.099
Gloeophyllum trabeum	Copper sulphate	0 (0)	0 (0)	0 (2)	3 (4)
	Water only	4 (4)			
Soft rot	Copper sulphate	2 (2)	3 (4)	4 (4)	4 (4)
	Water only	4 (4)			

a) 0 = no growth

1 = poor growth

2 = moderate growth

3 = good growth

4 = excellent growth

Table B5(5)-2. Weight loss of sawdust of spotted gum treated with copper sulphate after 12 weeks.

Inoculum	Formulation	Weight change %			
		% concentration in wood			
		12	2.4	0.48	0.099
Gloeophyllum trabeum	Copper sulphate	+ 0.9	- 3.6	- 8.1	- 9.4
	Water only	- 16.6			
Soft rot	Copper sulphate	- 0.5	- 6.8	- 8.7	- 10.2
	Water only	- 10.8			

Section A5(6) Annex Point IIA V.5.1 – V.5.1.3	Efficacy Data (efficacy against termites)	
	1 REFERENCE	Official use only
1.1 Reference	Fox, R.F., Pasek, E.A. and Patel, J. Laboratory Termite testing of Copper Boron Tebuconazole. International Research Group on Wood Preservation. Document No. IRG/WP 00-20192.	
1.2 Data protection	No.	
1.2.1 Data owner	Not applicable.	
1.2.3 Criteria for data protection	No data protection claimed.	
	2 GUIDELINES AND QUALITY ASSURANCE	
2.1 Guideline study	Yes. The test procedure followed the American Wood Preservers' Association (AWPA) Standard E1-97, "Standard Method for Laboratory Evaluation to Determine Resistance to Subterranean Termites".	
2.2 GLP	No. GLP is not applicable to studies of this type.	
2.3 Deviations	None.	
	3 MATERIALS AND METHODS	
3.1 Test material		
3.1.1 Preservative	The copper azole formulation used for this study was that listed in the AWPA P5 and C2 Standards for above and below ground uses (H3 and H4) as CBA-A. This formulation is comprised of 49% copper, 49% boric acid and 2% azole as tebuconazole, and is labelled at 25:25:1 for the weight ratio of copper:boric acid:azole. The ingredients are dissolved in ethanolamine (3.8 + 0.2 times weight of copper). The CBA-A concentrate contains 10.0 % copper.	
3.1.2 Termite test species	*Coptotermes formosanus* and *Reticulitermes flavipes*.	
3.1.3 Treated samples	a) Wood/Sizing: Sample wafers were 25.4 x 25.4 x 6.4 mm in size and cut in the radial direction from clear, kiln dried Southern Yellow pine sapwood. Samples were selected from material with 4 – 6 rings/inch. b) Preservative Treatment: Samples were treated by a full cell cycle (Bethell process). Samples were placed in small pans, weighted down with stainless steel weights and the treatment solution added prior to vacuum/pressure cycles. The treating schedule consisted of a 30 min vacuum at 88.0 kPa, followed by 15 min of pressure at 1030 kPa. After samples were returned to atmosphere pressure and removed from the treating solution they were patted dry on a paper towel and weighed to obtain the gauge retention. Wafers were treated with CBA-A treating solutions containing 0.32, 0.47 and 0.63% copper. Similarly, wafers were treated using a copper azole solution without boric acid, containing 0.33, 0.47 and 0.63 % copper. CCA-C solutions at 0.63 and 1.00 % total active oxides were used to treat reference samples. 25 wafers were treated with each treating solution for each termite species. c) Preservative Retention: The nominal retentions for copper azole preservative treatment were 3.3, 4.9 and 6.5 kg/m^3 total copper/ boric acid/tebuconazole. The same nominal retentions of copper/ tebuconazole were used for the copper azole formulation without boric	

	acid. The CCA-C target retentions were 4.0 and 6.4 kg/m^3. Average actual gauge retentions for wafers for each termite species are shown in **Table A5(6)-1** and **Table A5(6)-2**.	
3.2 Test method	The AWPA method provides for single-choice (no choice) or two-choice test procedures. 150 grams of washed, heat sterilized sand was added to screw cap containers, followed by 30 ml of distilled water. Five replicates were used for each retention, along with 5 untreated controls. Oven-dried wafers were weighed prior to testing and placed in the jars. For the no-choice test, wafers were placed above the sand, with two corners touching the container wall. For the choice test, wafers were placed above the sand at opposite sides of the container. 400 termites were then added to each container (360:40 and 380:20 worker:soldier ratio for *Coptotermes formosanus* and *Reticulitermes flavipes*, respectively). After 4 weeks, wafers were cleaned, dried, weighed, inspected and rated according to the following system: 10 Sound, surface nibbles 9 Light attack 7 Moderate attack, penetration 4 Heavy attack 0 Failure The number of "live" termites (workers and soldiers) was counted to assess % survival.	
	4 RESULTS AND DISCUSSION	
4.1 *Coptotermes formosanus* Tests	The results of the single wafer (no-choice) and the choice tests are summarized in **Table A5(6)-3** and **Table A5(6)-4**. The tests indicate that the copper azole (CBA-A)-treated samples with and without boric acid performed well against the Formosan termite. There was some light termite scarring at the lowest retention of 3.44 kg/m^3 total actives, but no termite penetration was observed above this retention.	
4.1.1 Weight loss/visual rating	Wafer weight loss and appearance ratings for both no-choice and choice tests show that, even for the lowest retention of copper azole (3.44 kg/m^3), protection against *C. formosanus* was observed. Weight losses for copper azole, with or without boric acid, ranged between 2.2 - 3.2% for the no-choice test and 1.0 - 1.9% for the choice test. Losses in the untreated controls for the no-choice and choice tests were 50.0 % and 41.9%, respectively. Ratings for the copper azole wafers ranged between 9.6 and 10.0 for the no choice test, and were all 10.0 for the choice tests, whereas those for the untreated controls were 0.8 for the no-choice and 1.6 for the choice tests. For the CCA-treated wafers good protection was observed even at a retention of 3.88 kg/m^3. Weight losses were about 1.8 - 1.9% for the no-choice and 0.3 - 0.6% for the choice tests. Wafer ratings were 10.0 for the no choice and 8.8 - 10.0 for the choice test. The slightly higher losses observed for the copper azole samples suggest more nibbling than for those treated with CCA. The efficacy of arsenic is shown in these laboratory tests. For example, at the lowest CCA retention of 3.88 kg/m^3 (0.72 kg/m^3 of copper), excellent protection was afforded. Addition of boric acid to copper azole samples gave little improvement in efficacy against Formosan termites. These additions ranged between 1.6 - 3.5 kg/m^3 BAE.	

Section A5(6)	Efficacy Data (efficacy against termites)	
Annex Point IIA V.5.1 – V.5.1.3		
4.1.2 Termite survival	Termite survival data for both no-choice and choice tests are summarised in **Table A5(6)-4** for both worker and soldier. For the no-choice test, boric acid increased the kill rate for copper azole. Comparing the copper boric acid tebuconazole formulation (CBA-A) to the copper tebuconazole formulation, there was an increase in termite survival of about 7% with the no-boron formulation. Thus, although the quantity of boric acid was insufficient to prevent *C. formosanus* attack, it did add to the number of termites killed. The CCA-C treated wafers in the no-choice test were very effective, killing all workers and soldiers. Some 20% of the termites apparently died from natural causes, as indicated by the untreated control. In the choice test, termites died of "natural causes" and not from any of the preservative formulations. All of the % survivals for all formulations were in the region of 80%. Thus, *C. formosanus* was quite selective in food, eating only the "healthy" food source.	
4.2 *Reticulitermes flavipes* Tests	The results obtained for the no-choice and choice tests are summarized in **Table A5(6)-5** and **Table A5(6)-6**. Copper Azole (CBA-A) with and without boric acid provided excellent protection against *R. flavipes* at all retention levels. Overall, the toxic threshold was less than the lowest copper azole retention of 3.53 kg/m^3 total actives.	
4.2.1 Weight loss/visual rating	Weight losses in the no-choice test ranged between 0.3 - 1.1% for both copper azole formulations (with/without boric acid) and ranged between 0 - 0.9% in the choice test. These losses for the *R. flavipes* termites are smaller than those for *C. formosanus*. CCA-C treated wafer controls gave very small weight losses for the no-choice and choice tests (0.00 - 0.04 %), suggesting that arsenic is an excellent termiticide. Untreated wafers gave a 29.0% loss in the no-choice and 19.2% in the choice test. These values were lower than the 50.0 and 41.9 % for the same tests with the *C. formosanus* species. The wafer rating for all samples containing preservative was 10.0; whereas, the rating for the untreated controls was 0.0.	
4.2.2 Termite survival	The % survival of *R. flavipes* in the no-choice test was found to be zero for all preservative formulations and 67 – 100% for the untreated wafers. Survival ranged between 67 – 100% for all samples (with/without preservative treatment) in the choice test. These results are similar to those observed for the *C. formosanus* tests, e.g. the termites selected the "safe" or "healthy" food source.	
4.3 Conclusions	The *Coptotermes formosanus* and *Reticulitermes flavipes* laboratory results suggest a toxic threshold of less than 3.5 kg/m^3 total actives. These laboratory termite results support the efficacy of copper azole at the AWPA at both the recommended Use Categories H3 and H4, i.e. 3.3 and 6.5 kg/m^3 total actives.	
	5 APPLICANT'S SUMMARY AND CONCLUSION	
5.1 Materials and methods	A study was carried out in accrdance with AWPA test method E1-97, "Standard Method for Laboratory Evaluation to Determine Resistance to Subterranean Termites". The formulation tested (CCA-A) contained copper, boric acid and tebuconazole at a ratio of 25:25:1. In order to simulate the impact of leaching in the field, southern yellow pine wafers were treated with formulations both with and without boric acid at nominal retentions of 3.3, 4.9 and 6.5 kg/m^3. Wafers treated with	

	CCA Type C (oxides) at 4.0 and 6.4 kg/m3 retentions were used as controls, as well as untreated pine. The AWPA method provides for single-choice (no choice) or two-choice test procedures. Vacuum/pressure treated pine wafers were exposed in sealed glass jars, containing amounts of sand and water stipulated by the guideline, to the termite species *Reticulitermes flavipes* (360:40 worker:soldier ratio) or *Coptotermes formosanus* (380:20 worker:soldier ratio) for 4 weeks. 5 replicate wafers were used for each retention/test species combination, along with 5 untreated controls. For the no-choice test, the wafer was placed above the sand with two corners touching the wall of the container. For the choice test, the wafers were placed above the sand at opposite ends of the container. Efficacy of the formulations tested was assessed in terms of weight loss from pine wafers and termite survival.	
5.2 Results and discussion	The results of the single wafer (no-choice) and the choice tests for *Coptotermes formosanus* are summarised in **Table A5(6)-3** and **Table A5(6)-4**. The tests indicate that the copper azole (CBA-A)-treated samples with and without boric acid performed well. There was some light termite scarring at the lowest retention of 3.44 kg/m^3 total actives, but no termite penetration was observed above this retention. Weight losses for the no-choice test using CBA-A with boric acid ranged between 2.25 - 3.00%. Losses without boric acid ranged between 2.43 – 3.17%. Weight losses for the choice test with boric acid ranged from 1.36 – 1.94%, whereas those without boric acid were in the range 1.00 – 1.52%. Losses in the untreated controls for the no-choice and choice tests were 50.0 % and 41.9%, respectively. Termite survival data for both no-choice and choice tests are summarised in **Table A5(6)-4** for both worker and soldier. For the no-choice test carried out using copper azole without boric acid there was an increase in termite survival of approximately 7%, thereby showing the termiticidal properties of boric acid. As tebuconazole is a fungicide and has no termiticidal properties, the efficacy seen in the copper azole treatments without boron may be attributed to the presence of copper. The results of the single wafer (no-choice) and the choice tests for *Reticulitermes flavipes* are summarised in **Table A5(6)-5** and **Table A5(6)-6**. Copper Azole (CBA-A) with and without boric acid provided excellent protection against *R. flavipes* at all retention levels. Weight losses in the no-choice test using CBA-A with boric acid ranged between 0.28 - 1.00%. Losses without boric acid ranged between 0.36 – 1.14%. Weight losses for the choice test with boric acid ranged from 0.00 – 0.92%, whereas those without boric acid were in the range 0.01 – 0.06%. Losses in the untreated controls for the no-choice and choice tests were 29.08% and 19.6%, respectively. The % survival of *R. flavipes* in the no-choice test was found to be zero for all preservative formulations and 67 – 100% for the untreated wafers. Survival ranged between 67 – 100% for all samples (with/without preservative treatment) in the choice test. Termites were therefore selecting the 'safer' food source. Overall, the toxic threshold was less than the lowest copper azole retention of 3.53 kg/m^3 total actives. In all cases, CCA-C treatment resulted in good protection of wafers and high mortality in both worker and soldier termites.	x
5.3 Conclusion	The *Coptotermes formosanus* and *Reticulitermes flavipes* laboratory results suggest a toxic threshold of less than 3.5 kg/m^3 total actives.	

Section A5(6)	Efficacy Data (efficacy against termites)	
Annex Point IIA V.5.1 – V.5.1.3		
	As tebuconazole is a fungicide and has no termiticidal properties, the efficacy seen in the copper azole treatments without boron may be attributed to the presence of copper. Validity criteria can be considered as fulfilled, in that the data presented in this report provides sufficient confidence in the results to allow them to be used as part of a broader evaluation of the efficacy of Cu^{2+} against wood-destroying fungi.	X x
5.3.1 Reliability	2	
5.3.2 Deficiencies	A number of minor reporting details were omitted from the report. However this did not detract from the reliability of the data derived or the robustness of the conclusions that were drawn. A reliability of 2 has been assigned on this basis.	
	Evaluation by Competent Authorities	
	Use separate "evaluation boxes" to provide transparency as to the comments and views submitted	
	EVALUATION BY RAPPORTEUR MEMBER STATE	
Date	June, the 25th,2009	
Materials and Methods	*Adopt applicant's version*	
Results and discussion	*Adopt applicant's version* *However,* There is no data showing that tebuconazole has no termicidal properties	
Conclusion	revised version The *Coptotermes formosanus* and *Reticulitermes flavipes* laboratory results suggest a toxic threshold of less than 3.5 kg/m^3 total actives. There is no data showing that tebuconazole has no termicidal properties. However, as tebuconazole is a fungicide, the efficacy seen in the copper azole treatments without boron may be attributed to the presence of copper. Validity criteria can be considered as fulfilled, in that the data presented in this report provides sufficient confidence in the results to allow them to be used as part of a broader evaluation of the efficacy of Cu^{2+} against termites belonging to the genus *Coptotermes* and *Reticulitermes*.	
Reliability	*Klimisch cotation 1 c:* (AWPA) Standard E1-97	
Acceptability	acceptable	
Remarks		
	COMMENTS FROM	
Date	*Give date of the comments submitted*	
Materials and Methods	*Discuss additional relevant discrepancies referring to the (sub)heading numbers and to applicant's summary and conclusion.* *Discuss if deviating from view of rapporteur member state*	
Results and discussion	*Discuss if deviating from view of rapporteur member state*	
Conclusion	*Discuss if deviating from view of rapporteur member state*	

Section A5(6) **Annex Point IIA V.5.1 – V.5.1.3**	**Efficacy Data (efficacy against termites)**	
Reliability	*Discuss if deviating from view of rapporteur member state*	
Acceptability	*Discuss if deviating from view of rapporteur member state*	

Table A5(6)-1. Average preservative retention as determined by solution concentration and sample retention for wafer tested with *Coptotermes formosanus*.

CBA-A

Target Copper		Copper		Boric Acid		Tebuconazole		Total CBA-A	
1.60	(0.100)	1.68	(0.105)	1.68	(0.105)	0.067	(0.0042)	3.44	(0.215)
2.40	(0.150)	2.59	(0.162)	2.59	(0.162)	0.104	(0.0065)	5.29	(0.331)
3.20	(0.200)	3.54	(0.221)	3.54	(0.221)	0.142	(0.0089)	7.22	(0.452)

CBA-A (no boron)

Target Copper		Copper		Boric Acid	Tebuconazole		Total CBA-A	
1.60	(0.100)	1.74	(0.109)	0.0	0.069	(0.0043)	1.75	(0.109)
2.40	(0.150)	2.59	(0.162)	0.0	0.099	(0.0062)	2.69	(0.168)
3.20	(0.200)	3.57	(0.223)	0.0	0.144	(0.0090)	3.71	(0.232)

Target CCA		CCA	
4.00	(0.250)	3.88	(0.243)
6.40	(0.400)	6.24	(0.398)

* Retentions expressed as kg/m^3 and (pcf).

Table A5(6)-2. Average preservative retention as determined by solution concentration and sample retention for wafer tested with *Reticulitermes flavipes*.

CBA-A

Target Copper		Copper		Boric Acid		Tebuconazole		Total CBA-A	
1.60	(0.100)	1.73	(0.108)	1.73	(0.108)	0.069	(0.0043)	3.53	(0.220)
2.40	(0.150)	2.55	(0.159)	2.55	(0.159)	0.102	(0.0063)	5.20	(0.325)
3.20	(0.200)	3.44	(0.215)	3.44	(0.215)	0.138	(0.0086)	7.02	(0.438)

CBA-A (no boron)

Target Copper		Copper		Boric Acid	Tebuconazole		Total CBA-A	
1.60	(0.100)	1.70	(0.106)	0.0	0.067	(0.0042)	1.77	(0.110)
2.40	(0.150)	2.66	(0.166)	0.0	0.106	(0.0066)	2.77	(0.173)
3.20	(0.200)	3.48	(0.217)	0.0	0.140	(0.0087)	3.62	(0.226)

Target CCA		CCA	
4.00	(0.250)	4.18	(0.261)
6.40	(0.400)	7.03	(0.438)

* Retentions expressed as kg/m^3 and (pcf).

Table A5(6)-3. ***Coptotermes formosanus*** **weight loss and visual inspection results**

Treatment	Preservative Retention kg/m³	(pcf)	No Choice Method Avg. Wt. Loss, %	Wafer Rating	Choice Method Avg. Wt. Loss, %	Wafer Rating
CBA-A	3.44	(0.215)	3.00	9.8	1.36	10.0
	5.29	(0.331)	2.25	10.0	1.94	10.0
	7.22	(0.452)	2.37	10.0	1.67	10.0
CBA-A (No Boric Acid)	1.75	(0.109)	3.17	9.6	1.00	10.0
	2.69	(0.168)	2.43	10.0	1.39	10.0
	3.71	(0.232)	2.59	10.0	1.52	10.0
CCA-C	3.88	(0.243)	1.83	10.0	0.30	10.0
	6.24	(0.398)	1.88	10.0	0.63	8.8
Untreated	0.0	(0.0)	49.98	0.8	41.89*	1.6*

* Average of 40 wafers.

Table A5(6)-4. ***Coptotermes formosanus*** **survival results**

Treatment	Preservative Retention Kg/m³	(pcf)	Percent Survival No Choice	Choice
CBA-A	3.44	(0.215)	38.3	82.1
	5.29	(0.331)	34.0	82.6
	7.22	(0.452)	31.4	81.6
CBA-A (No Boric Acid)	1.75	(0.109)	45.5	81.6
	2.69	(0.168)	39.3	82.6
	3.71	(0.232)	40.2	81.6
CCA-C	3.88	(0.243)	0.0	80.4
	6.24	(0.398)	0.0	79.3
Untreated	0.0	(0.0)	80.2	Na

Table A5(6)-5. ***Reticulitermes flavipes*** **weight loss and visual inspection results**

Treatment	Preservative Retention kg/m³	(pcf)	No Choice Method Avg. Wt. Loss, %	Choice Method Avg. Wt. Loss, %	Wafer Rating
CBA-A	3.53	(0.220)	0.28	0.00	10.0
	5.20	(0.325)	0.88	0.28	10.0
	7.02	(0.438)	1.00	0.92	10.0
CBA-A (No Boric Acid)	1.77	(0.110)	0.36	0.01	10.0
	2.77	(0.173)	0.65	0.01	10.0
	3.62	(0.226)	1.14	0.06	10.0
CCA-C	4.18	(0.261)	0.02	0.00	10.0
	7.03	(0.438)	0.04	0.05	10.0
Untreated	0.0	(0.0)	29.08	19.16	0

Table A5(6)-6. *Reticulitermes flavipes* survival results

Treatment	Preservative Retention Kg/m^3	(pcf)	Percent Survival No Choice	Percent Survival Choice
CBA-A	3.53	(0.220)	0	67 – 100
	5.20	(0.325)	0	67 – 100
	7.02	(0.438)	0	67 – 100
CBA-A (No Boric Acid)	1.77	(0.110)	0	67 – 100
	2.77	(0.173)	0	67 – 100
	3.62	(0.226)	0	67 – 100
CCA-C	4.18	(0.261)	0	67 – 100
	7.03	(0.438)	0	67 - 100
Untreated	0.0	(0.0)	67 – 100	67 – 100

Section A5(7) Annex Point IIA V.5.1 – V.5.1.3	Efficacy Data (efficacy against wood-destroying fungi and insects)	
	1 REFERENCE	Official use only
1.1 Reference	Connell, M., Cornfield, J.A. and Williams, G.R., 1993. A New Timber Preservative. Rec of the Annual Convention of the British Wood Preserving and Damp-proofing Association pp 28-36.	
1.2 Data protection	No.	
1.2.1 Data owner	Not applicable.	
1.2.3 Criteria for data protection	No data protection claimed.	
	2 GUIDELINES AND QUALITY ASSURANCE	
2.1 Guideline study	Yes. Relevant studies discussed in the report were carried out in accordance with EN 113 (Wood preservatives. Test method for determining the protective effectiveness against wood destroying basidiomycetes. Determination of the toxic values), EN 84 (Wood preservatives. Accelerated ageing of treated wood prior to biological testing. Leaching procedure), prENV 807 (Wood preservatives. Determination of the effectiveness against soft rotting micro-fungi and other soil inhabiting micro-organisms), EN 73 (Wood preservatives. Accelerated ageing tests of treated wood prior to biological testing - Evaporative ageing procedure) and EN 117 (Wood preservatives. Determination of toxic values against Reticulitermes species (European termites) (Laboratory method)). Note that only sections of the report relating to standardised test methods that may be used to support a discussion on the efficacy of Cu^{2+} in wood preservation have been included in this summary.	X1
2.2 GLP	No. GLP is not applicable to studies of this type.	
2.3 Deviations	None.	
	3 MATERIALS AND METHODS	
3.1 Basidiomycetes test according to EN 113	The UK Building Research Establishment (BRE) carried out tests on the product TANALITH 3485 (copper:tebuconazole, 25:1, 12.36% copper) according to European Standard test method EN 113 for assessing the performance of wood preservatives against basidiomycetes (*Coniophora puteana* BAM 15, *Coriolus versicolor* CTB 863A, *Gloeophyllum trabeum* BAM 109 and *Postia placenta* FPRL 280). All samples were aged by cold water leaching (EN 84). No additional experimental details were reported.	
3.2 Soft Rot Tests according to prENV 807	The efficacy of TANALITH 3485 against soft rot fungi was tested by the BRE using the vermiculite burial method and the soil burial test as described in ENV 807. Beech and pine sapwood samples were used. No additional experimental details were reported.	
3.3 Tests against *Hylotrupes bajulus*	Tests were conducted at the BRE to determine the effectiveness of TANALITH 3485 against the House Longhorn Beetle, *Hylotrupes bajulus*. The European Standard test method EN 47 was used and included evaporative ageing to EN 73. Results were obtained after dissection of blocks after 4 and 12 weeks. No additional experimental details were reported.	
3.4 Tests against	Termite tests according to the European Standard EN 117 were carried	

Section A5(7) Annex Point IIA V.5.1 – V.5.1.3	Efficacy Data (efficacy against wood-destroying fungi and insects)	
Termites	out at BRE with TANALITH 3485. This test used *Reticulitermes santonensis*. Treated blocks were leached according to EN 84 and then exposed to a small colony of the termites. After 8 weeks the blocks were removed and visually assessed for damage. No additional experimental details were reported.	
	4 RESULTS AND DISCUSSION	
4.1 Basidiomycetes test according to EN 113	The results of this test are summarised in **Table A5(7)-1**. The highest toxic threshold value obtained in this test was 4.22 – 12. 46 kg/m^3 TANALITH 3485 (0.53 – 1.56 kg/m^3 Cu), after EN 84 leaching against *Coniophora puteana*.	
4.2 Soft Rot Tests according to prENV 807	The results of this test are summarised in **Table A5(7)-2**. The soil test results were reported up to 24 weeks, rather than the extended exposure period of 32 weeks. On pine, very low retentions of TANALITH 3485 were effective in both the vermiculite and soil exposure tests (< 4.3 kg/m^3 product (< 0.54 kg/m^3 Cu) and < 8.7 kg/m^3 product (< 1.09 kg/m^3 Cu), respectively). (Results obtained using beech are considered not to be applicable to this summary, which focuses on efficacy in pine samples, and have therefore been omitted from this discussion).	
4.3 Tests against *Hylotrupes bajulus*	The results obtained after dissection of blocks at 4 and 12 weeks are given in **Table A5(7)-3**. At the end of four weeks, 1 live larva was recovered at the highest retention. This was replaced and all blocks incubated for a total of 12 weeks. At the end of this time, 1 live larva was recovered at the lowest retention (2.2 kg/m^3 TANALITH 3485, 0.27 kg/m^3 Cu). This provided a toxic threshold value of > 2.2 – 3.9 kg/m^3 TANALITH 3485 (0.27 – 0.48 kg/m^3 Cu).	
4.4 Tests against Termites	The untreated controls in this test were heavily attacked (rating 4.0). At a product retention of 12.26 kg/m^3, TANALITH 3485 treated blocks gave an average score of 1.7 (attempted or slight attack) and at 15.36 kg/m^3 a score of 1.0 (slight attack). This gave a toxic threshold of 12.26 – 15.36 kg/m^3 TANALITH 3485 (1.52 – 1.90 kg/m^3 Cu).	
4.5 Conclusions	It was concluded that copper azole formulations such as TANALITH 3485 have a good spectrum of activity and good permanence during both ageing and soil exposure test systems. Sterile laboratory tests according to European Standard test methods have give toxic thresholds below 12 kg/m^3 product (sapwood) for the formulated product TANALITH 3485 against basidiomycete fungi (including copper-tolerant strains), against soft rot fungi and against beetles and termites.	
	5 APPLICANT'S SUMMARY AND CONCLUSION	
5.1 Materials and methods	The following series of standard tests were carried out using pine samples treated with TANALITH 3485 (copper:tebuconazole, 25:1, 12.36% copper): Method EN 113 was used to assess the performance against basidiomycetes (*Coniophora puteana* BAM 15, *Coriolus versicolor* CTB 863A, *Gloeophyllum trabeum* BAM 109 and *Postia placenta* FPRL 280). All samples were aged by cold water leaching (EN 84). Efficacy against soft rot fungi was tested using the vermiculite burial	X2)

	method and the soil burial test described in ENV 807. Method EN 47 was used to determine effectiveness against the House Longhorn Beetle, *Hylotrupes bajulus* and included evaporative ageing to EN 73. Results were obtained after dissection of blocks after 4 and 12 weeks. Termite tests according to EN 117 were carried out using *Reticulitermes santonensis*. Treated blocks were leached according to EN 84 and then exposed to a small colony of the termites. After 8 weeks the blocks were removed and visually assessed for damage.	
5.2 Results and discussion	Results of the EN 113 test (with EN 84 leaching) are summarised in **Table A5(7)-1**. The highest toxic threshold value obtained in this test was 4.22 – 12. 46 kg/m^3 TANALITH 3485 (0.53 – 1.56 kg/m^3 Cu), after EN 84 leaching against *Coniophora puteana*. Results of the ENV 807 test are summarised in **Table A5(7)-2**. Toxic thresholds in the vermiculite and soil exposure tests were < 4.3 kg/m^3 product (< 0.54 kg/m^3 Cu) and < 8.7 kg/m^3 product (< 1.09 kg/m^3 Cu), respectively. Results of the EN 47 test (with EN 73 evaporative ageing) are given in **Table A5(7)-3**. After 4 weeks, 1 live larva was recovered at the highest retention. This was replaced and all blocks incubated for a total of 12 weeks, after which 1 live larva was recovered at the lowest retention (2.2 kg/m^3 TANALITH 3485). The toxic threshold value was > 2.2 – 3.9 kg/m^3 TANALITH 3485 (0.27 – 0.48 kg/m^3 Cu). In the EN 117 (with EN 84 leaching) test, untreated controls were heavily attacked (rating 4.0). At a product retention of 12.26 kg/m^3, TANALITH 3485 treated blocks showed evidence of ‘attempted’ or ‘slight’ attack and at 15.36 kg/m^3 the attack was ‘slight’. The toxic threshold was 12.26 – 15.36 kg/m^3 TANALITH 3485 (1.52 – 1.90 kg/m^3 Cu). The results of these tests demonstrate the toxicity (and hence efficacy) of copper to a number of species that are representative of the target organisms that are required to be controlled in the various Use classes of timber.	
5.3 Conclusion	Relevant toxic threshold values for copper presented in this summary are listed in **Table A5(7)-4**. Validity criteria can be considered as fulfilled, in that the data presented in this report provides sufficient confidence in the results to allow them to be used as part of a broader evaluation of the efficacy of Cu^{2+} against wood-destroying fungi and insects.	
5.3.1 Reliability	2	
5.3.2 Deficiencies	A number of reporting and methodology details were omitted from the report. However this did not detract from the reliability of the data derived or the robustness of the conclusions that were drawn. A reliability of 2 has been assigned on this basis.	
	Evaluation by Competent Authorities	
	Use separate "evaluation boxes" to provide transparency as to the comments and views submitted	
	EVALUATION BY RAPPORTEUR MEMBER STATE	

Section A5(7) Annex Point IIA V.5.1 – V.5.1.3	Efficacy Data (efficacy against wood-destroying fungi and insects)	
Date	June the 25th, 2009	
Materials and Methods	Adopt applicant's version	
Results and discussion	Adopt applicant's version	
Conclusion	revised version Validity criteria can be considered as fulfilled, in that the data presented in this report provides sufficient confidence in the results to allow them to be used as part of a broader evaluation of the efficacy of Cu^{2+} against soft and rot fungi and wood boring beetles and termites.	
Reliability	Klimish cotation: 1c (EN113, prENV 807, EN47 and EN117 standards)	
Acceptability	acceptable	
Remarks	X1: The test according EN47 is not mentioned in the guideline study section (2- 1). *X2: Poria placenta*	
	COMMENTS FROM	
Date	*Give date of the comments submitted*	
Materials and Methods	*Discuss additional relevant discrepancies referring to the (sub)heading numbers and to applicant's summary and conclusion.* *Discuss if deviating from view of rapporteur member state*	
Results and discussion	*Discuss if deviating from view of rapporteur member state*	
Conclusion	*Discuss if deviating from view of rapporteur member state*	
Reliability	*Discuss if deviating from view of rapporteur member state*	
Acceptability	*Discuss if deviating from view of rapporteur member state*	

Table A5(7)-1. Summary of results of EN 113 tests carried out on TANALITH 3485

Ageing	Test Fungi	Toxic Values (kg/m^3 TANALITH 3485)	Toxic Values (kg/m^3 Cu)
EN 84 Leaching	*Coniophora puteana* BAM 15	4.22 – 12.46	0.53 – 1.56
	Coriolus versicolor CTB 863A	< 4.23	< 0.53
	Gloeophyllum trabeum BAM 109	< 4.30	< 0.54
	Postia placenta FPRL 280	4.27 – 9.07	0.53 – 1.12

Table A5(7)-2. Summary of Soft Rot Testing to prENV 807 on TANALITH 3485

Product	Test Method	Species	Toxic Threshold (kg/m^3 TANALITH 3485)	Toxic Threshold (kg/m^3 Cu)
TANALITH 3485	Vermiculite	Pine	< 4.3	< 0.54
	Soil test (24 weeks)	Pine	< 8.7	< 1.09

Table A5(7)-3. Results of EN 47 Tests for TANALITH 3485

Mean Retention of Preservative (kg/m^3 TANALITH 3485)	Mean Retention of Copper (kg/m^3)	Larvae Retrieved			Larvae not retrieved
		Dead		Alive	
		Not tunnelling	Tunnelled		
19.7	2.43	At 4 weeks 2	3	1	0
At 12 weeks					
19.7	2.43	14	10	0	0
15.7	1.93	18	12	0	0
12.7	1.56	12	18	0	0
8.0	0.99	13	17	0	0

3.9	0.48	14	16	0	0
2.2	0.27	0	29	1	0
Water treated control		0	5	25	0
Untreated control		0	3	27	0

Table A5(7)-4. Summary table of experimental data on the effectiveness of Copper against target organisms.

Test Method	**Test organisms**	**Toxic threshold (Kg Cu/m^3 wood) defined by test method**
EN113 plus EN84 leaching	*Coniophora puteana* BAM 15*	0.53 – 1.56
As above	*Coriolus versicolor* CTB863A*	< 0.53
As above	*Gloeophyllum trabeum* BAM109*	< 0.54
As above	*Poria placenta* F PRL 280*	0.53 – 1.13
prENV807 vermiculite/Pine	Soft rot**	< 0.54
PrENV807 soil/Pine	Soft rot**	1.09
EN73 plus EN 84 leaching	*Hylotrupes bajulus* (House Longhorn beetle)	0.28 – 0.49
EN117 plus EN84 leaching	*Reticulitermes santonensis* (Subterranean termite)	1.53 – 1.92

Table A5(7)-4. Summary table of experimental data on the effectiveness of Copper against target

organisms.

*** wood destroying basidomycete fungus**
**** micro-fungi**

Section A5.4.1(2) Annex Point IIA V.5.4	Mode of Action (against termites)	
	REFERENCES	**Official use only**
27. References	Harris,W.V., 1961. Termites. Their Recognition and Control. Published by Longmans. Encyclopedia Britannica, 2009. Britannica Online Encyclopedia. "Termite". Abe, T., Bignell, D.E. and Higashi, M., 2000. Termites: evolution, sociality, symbioses, ecology. Published by Springer. Knight, D.J. and Cooke, M. (Ed), 2002. The Biocides Business. Regulation, Safety and Applications. Published by Wiley-VCH Verlag GmbH, Weinheim. UN, 2000. United Nations Environment Programme, Chemicals. Finding Alternatives to Persistant Organic Pollutants (POPs) for Termite Management. Prepared by members of the UNEP/FAO/Global IPM Facility Expert Group on Termite Biology and Management. Tamashiro, M., Yamamoto, R and Ebesu, R, 1998. Resistance of ACZA Treated Douglas-Fir Heartwood to the Formosan Subterranean Termite. American Wood Preservers' Association.	
28. Data protection	No	
Data owner	Not applicable	
Criteria for data protection	No data protection claimed	
29. Guideline study	Not applicable.	
30. Deviations	Not applicable.	
	31. REVIEW OF PUBLISHED LITERATURE	
	The diet of the lower, wood-boring termites consists entirely of plant material of a woody nature, principally cellulose. As these termites do not themselves secrete the enzymes which break down cellulose (cellulase and cellobiase), they rely on the symbiotic flagellate protozoa which live in their hind-gut to do this for them (Harris, 1961; Encyclopedia Britannica, 2009). They may also benefit from an improved supply of nitrogen and/or optimised routing of electrons during gut fermentations. The dependence of termites on their intestinal microbiota has been demonstrated in a number of studies in which removal of the protozoan flagellates lead to the death of the termite host in a period of time similar to that arising from starvation (Abe *et al*, 2000). The general categorisation of copper-based wood preservatives as "stomach acting insecticides" reflects the fact that the levels of copper consumed during ingestion of treated wood are toxic to the intestinal symbionts upon which many insects rely, and without which death of the insect host by starvation inevitably ensues (Knight & Cooke, 2002). The applicability of this mode of action to termites is evident from the various descriptions of copper-containing termiticides as a "metabolic poison" (UN, 2000) and a "stomach poison" (Tamashiro et al, 1998).	
	32. APPLICANT'S SUMMARY AND CONCLUSION	
33. Summary of the	Copper-based termiticides are "stomach poisons" that result in the death	

Section A5.4.1(2)	Mode of Action (against termites)	
Annex Point IIA V.5.4		
review	of the target organism by starvation following removal of symbiotic intestinal protozoa.	
34. Reliability	2	
35. Conclusion	Validity criteria can be considered as fulfilled, in that the discussion presented in this review contributes information that is suitable for use in a consideration of the termiticidal mode of action of copper ions in accordance with the requirements of the Biocidal Products Directive.	
	Evaluation by Competent Authorities	
	Use separate "evaluation boxes" to provide transparency as to the comments and views submitted	
	EVALUATION BY RAPPORTEUR MEMBER STATE	
Date	June the 25th,2009	
Materials and Methods	Not applicable	
Results and discussion	Adopt applicant's version	
Conclusion	Adopt applicant's version	
Reliability	Klimisch cotation; 2g	
Acceptability	acceptable	
Remarks	No comment	
	COMMENTS FROM ... *(specify)*	
Date	*Give date of comments submitted*	
Comments	*Discuss if deviating from view of rapporteur member state*	
Summary and conclusion	*Discuss if deviating from view of rapporteur member state*	

Section A5.4.1 Annex Point IIA V.5.4	Mode of Action (against wood-rotting fungi)	
	REFERENCE	Official use only
36. **Reference**	Eaton, R.A and Hale, M.D.C., 1993. In: Wood. Decay, Pests and Protection. Chapman and Hall (Publishers).	
37. **Data protection**	No	
Data owner	Not applicable	
Criteria for data protection	No data protection claimed	
38. **Guideline study**	Not applicable - This information is presented in a general review of the fungicidal mode of action of copper.	
39. **Deviations**	No Not applicable - This information is presented in a general review of the fungicidal mode of action of copper.	
	40. CONTENTS OF THE REVIEW	
	It is considered that the fungicidal properties of copper compounds are dependent on the affinity of the copper ion (Cu^{2+}) for different chemical groups within cells, particularly thiol groups, resulting in the nonspecific denaturation of proteins and enzymes. In addition, it is thought that copper ions can interfere with the activity of the pyruvate dehydrogenase system inhibiting the conversion of pyruvate to acetyl CoA within mitochondria.	
	41. APPLICANT'S SUMMARY AND CONCLUSION	
42. **Summary of the review**	A brief discussion of the mode of action for the fungicidal activity of copper in wood preservation was presented. Fungicidal properties were considered to depend on the affinity of copper ions (Cu^{2+}) for different chemical groups within cells, particularly thiol groups, resulting in the non-specific denaturation of proteins and enzymes. It is also thought that copper ions interfere with the activity of the pyruvate dehydrogenase system, thereby inhibiting conversion of pyruvate to acetyl CoA within mitochondria.	
43. **Reliability**	2	
44. **Conclusion**	Validity criteria can be considered as fulfilled, in that the discussion presented in this review contributes information that is suitable for use in a consideration of the fungicidal mode of action of copper ions in accordance with the requirements of the Biocidal Products Directive.	
	Evaluation by Competent Authorities	
	Use separate "evaluation boxes" to provide transparency as to the comments and views submitted	
	EVALUATION BY RAPPORTEUR MEMBER STATE	
Date	June the 25th, 2009	
Materials and Methods	Not applicable	
Results and discussion	Adopt applicant's version	

Section A5.4.1	**Mode of Action (against wood-rotting fungi)**	
Annex Point IIA V.5.4		
Conclusion	Adopt applicant's version	
Reliability	Klimisch cotation; 2g	
Acceptability	acceptable	
Remarks		
	COMMENTS FROM	
Date	*Give date of the comments submitted*	
Materials and Methods	*Discuss additional relevant discrepancies referring to the (sub)heading numbers and to applicant's summary and conclusion.* *Discuss if deviating from view of rapporteur member state*	
Results and discussion	*Discuss if deviating from view of rapporteur member state*	
Conclusion	*Discuss if deviating from view of rapporteur member state*	
Reliability	*Discuss if deviating from view of rapporteur member state*	
Acceptability	*Discuss if deviating from view of rapporteur member state*	

Subsection (Annex Point)		Official use only
5.8 Likely tonnage to be placed on the market per year (IIA5.8)	*Including imported quantities. Indicate also quantities for use other than biocides.* [redacted]	

	Evaluation by Competent Authorities
	Use separate "evaluation boxes" to provide transparency as to the comments and views submitted
	EVALUATION BY RAPPORTEUR MEMBER STATE
Date	**9 July 2009**
Materials and methods	**-**
Conclusion	**-**
Reliability	-
Acceptability	*acceptable*
Remarks	
	COMMENTS FROM ...
Date	*Give date of comments submitted*
Results and discussion	*Discuss additional relevant discrepancies referring to the (sub)heading numbers and to applicant's summary and conclusion.* *Discuss if deviating from view of rapporteur member state*
Conclusion	*Discuss if deviating from view of rapporteur member state*
Reliability	*Discuss if deviating from view of rapporteur member state*
Acceptability	*Discuss if deviating from view of rapporteur member state*
Remarks	

See Confidential Sections