[1] **MANAGEMENT OF PEST RISKS ASSOCIATED WITH THE INTERNATIONAL MOVEMENT OF WOOD (2006-029)**

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[3]

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[4] **CONTENTS *(To be inserted later)***

[5] **INTRODUCTION**

[6] **Scope**

[7] This standard describes phytosanitary measures intended to reduce the risk of introduction and spread of quarantine pests associated with the international movement of wood (with or without bark). This standard covers the fibre products of gymnosperms, angiosperms (i.e. dicotyledonous species) and monocotyledons, such as palms. The standard does not cover bamboo products.

[8] Wood as a commodity class includes round wood, sawn wood, residual products from the mechanical processing of wood (chips, sawdust and wood residue) and processed wood material (plywood, pellets, oriented strand board and fibreboard), all with or without bark.

[9] Wood packaging material is covered within the scope of ISPM 15:2009. Wood packaging material that has not been treated and marked in compliance with ISPM 15:2009 and is moved in international trade is covered within the scope of this standard.

[10] **Impact on Biodiversity and the Environment**

[11] Quarantine pests associated with wood moved in international trade are known to have negative impacts on tree health and forest biodiversity. Implementation of this standard is considered to reduce significantly the likelihood of introduction and spread of quarantine pests and subsequently their negative impacts. Countries are encouraged to promote the use of phytosanitary measures that are environmentally acceptable.

[12] **References**

[13] **CPM.** 2008. Replacement or reduction of the use of methyl bromide as a phytosanitary measure. IPPC Recommendation. *In* Report of the Third Session of the Commission on Phytosanitary Measures. Rome, 7–11 Apr. 2008, Appendix 6. Rome, IPPC, FAO.

[14] **FAO.** 2009. *Global review of forest pests and diseases.* FAO Forestry Paper 156. Rome. 222 pp.

[15] **ISPM 2.** 2007. *Framework for pest risk analysis.* Rome, IPPC, FAO.

[16] **ISPM 4.** 1995. *Requirements for the establishment of pest free areas.* Rome, IPPC, FAO.

[17] **ISPM 5.** *Glossary of phytosanitary terms.* Rome, IPPC, FAO.

[18] **ISPM 7.** 2011. *Phytosanitary certification system.* Rome, IPPC, FAO.

[19] **ISPM 8.** 1998. *Determination of pest status in an area.* Rome, IPPC, FAO.

[20] **ISPM 10.** 1999. *Requirements for the establishment of pest free places of production and pest free production sites.* Rome, IPPC, FAO.

[21] **ISPM 11.** 2004. *Pest risk analysis for quarantine pests including analysis of environmental risks and living modified organisms.* Rome, IPPC, FAO.

[22] **ISPM 12.** 2011. *Phytosanitary certificates.* Rome, IPPC, FAO.

[23] **ISPM 13.** 2001. *Guidelines for the notification of non-compliance and emergency action.* Rome, IPPC, FAO.

[24] **ISPM 14.** 2002. *The use of integrated measures in a systems approach for pest risk management.* Rome, IPPC, FAO.

[25] **ISPM 15.** 2009. *Regulation of wood packaging material in international trade.* Rome, IPPC, FAO.

[26] **ISPM 18.** 2003. *Guidelines for the use of irradiation as a phytosanitary measure.* Rome, IPPC, FAO.

[27] **ISPM 20.** 2004. *Guidelines for a phytosanitary import regulatory system.* Rome, IPPC, FAO.

[28] **ISPM 22.** 2005. *Requirements for the establishment of areas of low pest prevalence.* Rome, IPPC, FAO.

[29] **ISPM 23.** 2005. *Guidelines for inspection.* Rome, IPPC, FAO.

[30] **ISPM 25.** 2006. *Consignments in transit.* Rome, IPPC, FAO.

[31] **ISPM 28.** 2007. *Phytosanitary treatments for regulated pests.* Rome, IPPC, FAO.

[32] **ISPM 29.** 2007. *Recognition of pest free areas and areas of low pest prevalence.* Rome, IPPC, FAO.

[33] **ISPM 31.** 2008. *Methodologies for sampling of consignments.* Rome, IPPC, FAO.

[34] **ISPM 32.** 2009. *Categorization of commodities according to their pest risk*. Rome, IPPC, FAO.

[35] **Definitions**

[36] Definitions of phytosanitary terms used in this standard can be found in ISPM 5.

[37] **Outline of Requirements**

[38] Pest risk varies among different wood commodities – round wood, sawn wood, mechanically processed wood and processed wood material – depending on the level of processing that the wood has undergone and the presence or absence of bark. This standard describes the general pest risk profile for each commodity by indicating the major pest groups associated with each one.

[39] Pest risk analysis (PRA), which is carried out by the national plant protection organization (NPPO) of the importing country, should provide the technical justification for phytosanitary import requirements for quarantine pests associated with the international movement of wood.

[40] Various options for phytosanitary measures for managing the pest risks related to wood, including bark removal, treatment, chipping and inspection, are described in this standard. Specific phytosanitary requirements such as verification of measures that have been applied and phytosanitary certification that may be applied before harvest or that are intended for post-harvest application at any point up to import of wood consignments are also described.

[41] The NPPO of an importing country may require the removal of bark (to produce debarked or bark-free wood) as a phytosanitary import requirement and may set tolerances for residual levels of bark.

[42] **BACKGROUND**

[43] Wood originating from living or dead trees may be infested by organisms (e.g. insects, fungi, nematodes, bacteria). Pests that have been shown historically to move with wood in international trade include insects that oviposit on bark (e.g. Lymantriidae), wood wasps, wood borers and wood-inhabiting nematodes. Certain fungi with dispersal stages that can be transported on wood may establish themselves in new areas. Therefore, wood (with or without bark) moved as a commodity class is a potential pathway for the introduction and spread of quarantine pests.

[44] The pest risk presented by a wood commodity is dependent on a wide range of characteristics, such as the commodity's type, the presence or absence of bark, and factors such as the wood's origin, the intended use and the treatment (if any) applied to the wood. Wood is commonly moved as one of four commodities: round wood, sawn wood, mechanically processed wood and processed wood material.

[45] Wood is usually moved internationally with a specific destination and an intended use. But wood commodities in trade increasingly move through intermediaries, whose handling of the commodity may complicate the identification of its ultimate use. Given the frequency of association between key pest groups and key wood commodities, it is feasible to provide guidance on phytosanitary measures for use internationally. The intention of this guidance is to effectively manage the risk of introduction and spread of quarantine pests and where possible harmonize the use of appropriate phytosanitary measures for their control by countries.

[46] It is important to note that the phytosanitary measures referred to in this standard should not be required as phytosanitary import requirements without appropriate technical justification. This technical justification should be based on PRA (as described in ISPM 2:2007 and ISPM 11:2004), including:

[47] - the pest status in the area of origin of the wood

[48] - the ability of a pest to survive on or in the wood

[49] - the intended use of the commodity

[50] - the likelihood of establishment of a pest in the area of destination.

[51] ISPM 15:2009 provides guidance on regulating wood packaging material in international trade.

[52] The FAO publication *Global review of forest pests and diseases* (2009) provides information on some of the major forest pests of the world.

[53] To differentiate wood from bark as used in this standard, a drawing and photographs of a cross-section of round wood are provided in Appendix 1.

[54] **REQUIREMENTS**

[55] **1. Pest Risks Related to Wood Commodities**

[56] The pest risks of the wood commodities addressed in this standard vary depending on the wood species and characteristics, the level of processing the wood has undergone, and the presence or absence of bark on the wood. This standard describes the general pest risks related to each wood commodity by indicating the major pest groups associated with it. Although the wood commodities described may be commonly infested with certain pest groups, as described in the background section, the pest risk actually presented may vary

based on factors such as species and size of the wood, intended use of the wood, and pest status in the area of destination. Options for phytosanitary measures are provided in section 2.

[57] Wood may contain one or more of the wood pests present in the area of origin at the time of harvesting. Outbreaks of pests in the area of origin, silvicultural and other management practices, storage time, and treatments applied to the wood once felled can all influence pests' ability to survive on or in the harvested wood, and subsequently can influence the introduction and spread of pests.

[58] In general, the greater the level of processing or treatment of the wood after harvest, the greater the reduction in pest risk at the wood's destination. Pests that are associated with specific wood tissues (e.g. bark and outer sapwood) pose virtually no pest risk when the tissues that they inhabit are removed during processing, provided that the removed material is not moved in trade as another commodity (e.g. cork, fuel wood, bark mulch).

[59] The 17 pest groups identified in Table 1 are known to have moved with wood commodities and have shown the potential to establish themselves in new areas.

[60] **Table 1.** Pest groups of potential quarantine concern associated with the international movement of wood commodities

[61]

Insects		**Fungi and nematodes**	
Pest group	**Examples within the pest group**	**Pest group**	**Examples within the pest group**
Bark beetles	Scolytinae	Rust fungi	Cronartiaceae, Pucciniaceae
Wood flies	Pantophthalmidae	Decay fungi	*Heterobasidion* spp.
Wood-boring beetles	Cerambycidae, Curculionidae, Buprestidae	Canker fungi	Cryphonectriaceae
Wood moths	Cossidae	Deep-penetrating blue-stain fungi	Ophiostomataceae
Wood wasps	Siricidae	Surface blue-stain fungi	Ophiostomataceae
Powder post beetles	Anobiidae, Bostrichidae	Vascular wilt fungi	Nectriaceae
Termites and carpenter ants	Rhinotermitidae, Kalotermidae, Formicidae	Nematodes	*Bursaphelenchus xylophilus*, *B. cocophilus*
Moths	Lymantriidae		
Aphids, adelgids	Adelgidae		
Scales	Diaspididae		

[62] There are some pest groups such as water moulds and bacteria known to be associated with wood but there is currently little evidence of these organisms establishing and spreading from wood into new areas. These pest groups are therefore not included in this standard.

[63] There are also some pest groups such as viruses and phytoplasmas known to be associated with wood but that are not known to be capable of establishing from the wood commodities described in this standard. These pest groups are therefore not included in this standard.

[64] It should also be noted that within the 17 pest groups listed in Table 1 there are some species that are associated with plants for planting or foliage only: these are not be considered under this standard.

[65] **1.1 Round wood**

[66] Most round wood, with or without bark, is moved for subsequent processing at destination. The wood may be sawn for use as construction material (such as timber framing) or it may be used to produce forest products (such as wood chips, bark chips, pulp, manufactured wood products and biofuels). Round wood also may have an intended use as firewood. Round wood with bark is often referred to as logs, and round wood without bark as poles or debarked logs.

[67] Removing bark from round wood can significantly reduce the risk of introduction and spread of some quarantine pests: the level of reduction depends on the degree to which the bark and underlying wood have been removed and on the pest group. For example, complete bark removal (i.e. to produce bark-free wood) will eliminate the risk of infestation of most bark beetles in the wood. However, bark removal is unlikely to influence the occurrence of deep wood borers, some species of fungi or wood-inhabiting nematodes.

[68] It is important to note that the total amount of residual bark on debarked wood is, in some cases, greatly influenced by the shape of the round wood and the machinery used to remove the bark as well as, to a lesser extent, by the species of tree involved. Residual bark is often found in the widened area at the base of a tree, especially where large root buttresses are present, and around branch nodes. These areas are known to be preferred locations for beetle infestation and oviposition.

[69] The pests associated with round wood are listed in Table 2.

[70] **Table 2.** Pests associated with round wood

[71]

Commodity	Pest groups likely to be associated with the commodity	Pest groups less likely to be associated with the commodity
Round wood with bark	Bark beetles, wood flies, wood-boring beetles, wood moths, wood wasps, powder post beetles, termites and carpenter ants, moths, aphids and adelgids, scales, rust fungi, decay fungi, canker fungi, deep-penetrating blue-stain fungi, surface blue-stain fungi, vascular wilt fungi, nematodes	
Round wood without bark	Wood flies, wood-boring beetles, wood moths, wood wasps, powder post beetles, termites and carpenter ants, decay fungi, canker fungi, deep-penetrating blue-stain fungi, surface blue-stain fungi, vascular wilt fungi, nematodes	Bark beetles[1], moths, aphids and adelgids, scales, rust fungi

[72] [Footnote 1] Some bark beetles have life stages that are found in the wood below the surface of the bark and cambium and, therefore, may be present after debarking or complete bark removal.

[73] **1.2 Sawn wood**

[74] Most sawn wood is moved as wood with or without bark for use in building construction, in the manufacture of furniture, and for the production of wood packaging material, wood lathing, wood stickers, wood spacers, railway ties and other constructed wood products. Sawn wood includes fully squared pieces of wood without bark, sawn from round wood, and partially squared wood with one or more curved edges that may or may not include bark. The pest risk of bark-related organisms is generally lower the smaller the bark piece. The

risk of bark-related organisms is also dependent on the moisture content of the wood. Freshly harvested wood has a high moisture content that decreases over time to ambient moisture conditions, which are less likely to allow bark-related pests to persist.

[75] The presence of bark on untreated wood commodities may increase the risk of introduction and spread of quarantine pests. Sawn wood from which some or all bark has been removed therefore presents a much lower pest risk than sawn wood with bark.

[76] The pests associated with sawn wood are listed in Table 3.

[77] **Table 3.** Pests associated with sawn wood

[78]

Commodity	**Pest groups likely to be associated with the commodity**	**Pest groups less likely to be associated with the commodity**
Sawn wood with bark	Bark beetles, wood flies, wood-boring beetles, wood moths, wood wasps, powder post beetles, termites and carpenter ants, rust fungi, decay fungi[2], canker fungi, deep-penetrating blue-stain fungi, surface blue-stain fungi, vascular wilt fungi, nematodes	Moths, aphids and adelgids, scales[3]
Sawn wood without bark	Wood flies, wood-boring beetles, wood moths, wood wasps, powder post beetles, termites and carpenter ants, decay fungi[3], canker fungi, deep-penetrating blue-stain fungi, surface blue-stain fungi, vascular wilt fungi, nematodes	Bark beetles, moths, aphids and adelgids, scales rust fungi

[79] [Footnote 2] Although decay fungi may be present in wood, most present a low pest risk because of the intended use of the wood and the limited potential for the fungi to produce spores on the wood.

[80] [Footnote 3] Many species are removed during the squaring of wood, but remaining bark may present sufficient surface area for species to persist after sawing.

[81] **1.3 Mechanically processed wood (excluding sawn wood)**

[82] Mechanically processed wood with or without bark results from various mechanical processes that reduce the wood size but do not use glue or heat, which would render the wood free of pests. This wood commodity includes chips, sawdust and wood residue (e.g. large pieces or offcuts of round or sawn wood).

[83] **1.3.1 Wood chips**

[84] The pest risks of wood chips may vary with their quality and uniformity. Some pest risks may be reduced when bark is removed and the chip size is below 3 cm in two dimensions (as described in Table 4). Chip size varies according to industry specifications and is usually related to the intended use of the chips.

[85] The pest risks of wood chips may vary with their intended use (i.e. as a biofuel, in paper production or for horticulture). The physical process of wood chipping is in itself lethal to some insect pests, particularly when a small chip size is produced.

[86] Many species of decay fungi may be present in wood chips with or without bark but pose a low pest risk because of their limited potential to develop spore-producing structures. Similarly, spore dispersal of wood-inhabiting rust fungi would be very unlikely after the production of chips.

[87] **1.3.2 Sawdust**

[88] Sawdust should not normally be considered to present a pest risk; only in rare cases may fungi and nematodes associated with sawdust be a consideration for PRA.

[89] **1.3.3 Wood residue**

[90] Wood residue is normally considered to present a high pest risk because it varies greatly in size and may or may not contain bark. Wood residue is generally produced as a waste by-product of wood being mechanically processed during production of a desired article; nevertheless, wood residue may be moved as a consignment. Most wood chip commodities have strict quality standards to minimize bark and fines (very small particles).

[91] The pests associated with wood chips and wood residue are listed in Table 4.

[92] **Table 4.** Pests associated with wood chips and wood residue

[93]

Commodity	**Pest groups likely to be associated with the commodity**	**Pest groups less likely to be associated with the commodity**
Wood chips with bark and greater than 3 cm in two dimensions	Bark beetles, wood-boring beetles, wood moths, wood wasps, rust fungi[4], decay fungi[5], canker fungi, deep-penetrating blue-stain fungi, surface blue-stain fungi, vascular wilt fungi, nematodes	Moths, aphids and adelgids, scales[6]
Wood chips without bark and greater than 3 cm in two dimensions	Wood-boring beetles, wood moths, wood wasps, rust fungi[4], decay fungi[5], canker fungi, deep-penetrating blue-stain fungi, surface blue-stain fungi, vascular wilt fungi, nematodes	Bark beetles, moths, aphids and adelgids[6], scales
Wood chips with bark and less than 3 cm in two dimensions	Bark beetles, wood-boring beetles, rust fungi[4], decay fungi[5], canker fungi, deep-penetrating blue-stain fungi, surface blue-stain fungi, vascular wilt fungi, nematodes	Wood flies, wood moths, wood wasps, moths, aphids and adelgids, scales
Wood chips without bark and less than 3 cm in two dimensions	Powder post beetles, termites and carpenter ants, rust fungi[4], decay fungi[5], canker fungi, deep-penetrating blue-stain fungi, surface blue-stain fungi, vascular wilt fungi, nematodes	Bark beetles, wood flies, wood-boring beetles, wood moths, wood wasps, moths, aphids and adelgids, scales

Wood residue with or without bark	Bark beetles, wood flies, wood-boring beetles, wood moths, wood wasps, powder post beetles, termites and carpenter ants, moths, aphids/adelgids, scales, rust fungi[4], decay fungi[5], canker fungi, deep-penetrating blue-stain fungi, surface blue-stain fungi, vascular wilt fungi, nematodes	

[94] [Footnote 4] Although rust fungi may be present in wood, spore dispersal would be very unlikely after processing the wood into chips.

[95] [Footnote 5] Although decay fungi may be present in wood, most present a low pest risk because of their limited potential to produce spores on wood.

[96] [Footnote 6] Moths, aphids and adelgids and scale insects are unlikely to be found on wood chips less than 3 cm in two dimensions.

[97] **1.4 Processed wood material**

[98] Processed wood material includes plywood, oriented strand board, medium density fibreboard, flakeboard and other thin wood veneers. Most processed wood material is produced by heating small pieces or thin sheets of wood that are then glued together under pressure. Processed wood material does not include composite sawn wood such as laminated beams, which may use glue, heat and pressure in its production but also uses wood of large dimension in which the pest risks may remain after the wood undergoes lamination. Composite wood therefore may present the same pest risks as sawn wood.

[99] The movement of processed wood material should generally not be regulated, because most pests present in the raw wood are destroyed when the wood is processed to produce wood pieces or during heating and gluing. Processed wood material, however, may be susceptible to infestation by termites and carpenter ants.

[100] **2. Phytosanitary Measures**

[101] Various options for phytosanitary measures are described below. Some of these phytosanitary measures may be applied before harvest, and some are intended for post-harvest application at any point up to import of the wood commodity by another country. Certain phytosanitary measures may be implemented to protect wood that has been produced in pest free areas but that may be at risk of infestation after harvest.

[102] The NPPO of the exporting country is responsible for monitoring the application of phytosanitary measures before export to verify compliance with phytosanitary import requirements and the phytosanitary certification of export consignments. Some phytosanitary measures, such as limitations on the intended use of the commodity to reduce pest risks, may be applied after import.

[103] The NPPO of the importing country may monitor the application of specific methods of processing or handling that render the imported commodities free of pests; for example, the use of imported wood chips within a prescribed, low-risk time frame; the use of sawn wood in building construction; and the appropriate disposal of waste.

[104] The application of the phytosanitary measures listed below, when they are applied independently, may not prevent subsequent infestation by pests after treatment. Therefore, prevention of infestation after the application of a measure should be considered; for example, covering the wood commodity with tarpaulin for storage or using a roofed conveyance.

[105] In selecting appropriate phytosanitary measures, NPPOs should take into account the IPPC Recommendation *Replacement or reduction of the use of methyl bromide as a phytosanitary measure* (CPM, 2008) and thus promote the use of alternative treatments.

[106] The following phytosanitary measures are not listed in any particular order (e.g. of efficacy, cost or ease of use).

[107] **2.1 Bark-related treatments**

[108] **2.1.1 Removal of bark**

[109] Some quarantine pests are commonly found in or just beneath the bark. The pest risk can therefore be reduced significantly when bark is removed from wood either partially or completely. Where bark remains with wood, treatments may be used to reduce pest risk.

[110] **2.1.1.1 Bark-free wood**

[111] The complete removal of bark from round wood and other regulated wood articles (i.e. to produce bark-free wood) physically removes a layer of material in which a large number of pests may develop, as well as eliminates large areas of uneven surface that provide concealment for other pests.

[112] Bark removal eliminates pests mostly found on the surface of bark such as aphids, adelgids, scale insects, and moths in some life stages. Bark removal eliminates most bark beetles and also prevents infestation by wood pests such as wood wasps and large wood borers (e.g. *Monochamus* spp.).

[113] **2.1.1.2 Debarked wood**

[114] The mechanical process used in the commercial removal of bark from wood does not usually result in the wood becoming free from bark.

[115] When wood is debarked, small pieces of bark may remain. Depending on the number and size of pieces remaining, pests associated with the bark may be removed (e.g. bark beetles, adelgids, scales). The incidence of some wood borers which live close to the cambium may also be reduced in debarked wood compared with wood before debarking. Depending on the moisture content of the wood and the size of the bark pieces remaining on the wood, debarked wood may still present suitable conditions for infestation or maturation of certain pests.

[116] Bark beetles may infest remnants of bark after the application of treatments to kill organisms in or on the wood. Debarking to the tolerances prescribed below reduces the risk of bark beetles completing their life cycles in untreated wood, and prevents bark beetles infesting and completing their life cycles in suitably treated wood. Any number of visually separate and clearly distinct remaining bark pieces should be tolerated, if the bark pieces are:

[117]
- less than 3 cm in width (regardless of the length) or

[118]
- greater than 3 cm in width, with the total surface area of an individual piece of bark less than 50 cm^2.

[119] The removal of bark often improves treatment efficacy and may aid inspection to verify the absence of specific pests (e.g. bark beetles and other surface-inhabiting pests).

[120] **2.2 Other treatments**

[121] Some treatment types may not be effective against all pests. For all chemical treatments, the penetration depth and thus the efficacy varies with the application process (dosage, temperature etc.), the presence or absence of bark on the wood, and the wood species and moisture content. Treatments accepted internationally may be found as annexes to ISPM 28:2007.

[122] **2.2.1 Fumigation**

[123] Fumigation is often used in controlling pests associated with all wood commodities.

[124] Despite the proven effectiveness of some fumigants against certain pests, there are limitations to their use to reduce pest risk. Fumigants vary in their ability to penetrate deeply into the wood and some are therefore effective only against pests in, on or just beneath the bark. The penetration depth for some fumigants may be limited to about 100 mm from the wood surface. Penetration is greater in dry than in green wood.

[125] Bark should be removed before fumigation to improve the efficacy of some active ingredients.

[126] **2.2.2 Chemical diffusion**

[127] Chemical diffusion is often used in controlling pests associated with all wood commodities, excluding bark, wood chips, sawdust and wood residue.

[128] In the chemical diffusion process, fluid or dissolved chemicals are applied at ambient pressure to wood by spraying or dipping. This treatment results in limited penetration into sapwood. Penetration depends on the wood species and the properties of the chemical ingredient – most chemicals do not penetrate beyond a few millimetres. Both removal of bark and application of heat increase the depth of penetration into the sapwood. The active ingredient of the treatment may not prevent the emergence of pests from the wood. The protection of the treated wood from pest infestation depends on the layer of chemical remaining intact. Post-treatment infestation by some pests (e.g. dry wood borers) may take place if the wood is further sawn after treatment and a portion of the cross-section has not been penetrated by the chemical.

[129] **2.2.3 Chemical pressure impregnation**

[130] Chemical pressure impregnation is used to control pests associated with all wood commodities, excluding bark, wood chips, sawdust and wood residue.

[131] The application of a preservative using a vacuum or pressure, or thermal processes, results in a chemical applied to the surface of the wood being forced deep into that wood.

[132] Chemical pressure impregnation is commonly used to preserve wood from infestation by pests after treatment. It may also have some effect in preventing the emergence to the wood surface of pest individuals that have survived treatment. The process is very similar to chemical diffusion but the chemical penetration into the wood fibre is much greater. The depth of penetration depends on the wood species and the properties of the chemical; penetration is generally throughout the sapwood but through only a limited portion of the heartwood. If the wood is mechanically perforated or debarked before treatment, the depth of penetration may be improved. Chemical pressure impregnation is often effective against some wood-boring insects. In some impregnation processes, the chemical is applied at a temperature sufficiently high to be equivalent to a heat treatment. The long-term effect of the chemical on the treated wood depends on the protective layer of chemical remaining intact. Post-treatment infestation by some pests (e.g. dry wood borers) may take place if the wood is sawn after treatment and a portion of the cross-section has not been penetrated by the chemical.

[133] **2.2.4 Heat treatment**

[134] Heat treatment may be applied to all wood commodities. The presence or absence of bark has no effect on the efficacy of heat treatment but should be taken into account if a heat treatment specifies the maximum dimensions of the wood being treated.

[135] The process of heat treatment involves heating wood to a temperature and for a period of time (with or without moisture reduction) that is specific to the target pest. The minimum treatment temperature in the heat chamber necessary to reach the required temperature to the necessary depth of all wood pieces depends on the wood's dimensions, species and density. The heat may be produced in a conventional heat treatment chamber or by dielectric, solar and other means of heating.

[136] The temperature required to kill wood pests varies because some species can tolerate higher temperatures than others. Heat-treated wood may still be susceptible to common moulds, particularly if moisture content remains high; however, mould should not be considered a phytosanitary concern.

[137] **2.2.5 Kiln-drying**

[138] Kiln-drying is routinely used on sawn wood but may be used on many other wood commodities.

[139] Kiln-drying is a commercial process in which the moisture in wood is reduced, by the application of heat, such that it is in equilibrium with the intended use of the wood. If kiln-drying is carried out at and for sufficient temperatures and durations, respectively, it may be deemed equivalent to heat treatment. If lethal temperatures are not achieved throughout the relevant wood layers, kiln-drying on its own should not be considered a phytosanitary treatment.

[140] Some species within the wood commodity pest groups are dependent on moisture and therefore some may be inactivated during kiln-drying. Kiln-drying also permanently alters the physical structure of the wood, which prevents subsequent resorption of sufficient moisture to sustain existing pests and reduces the incidence of post-harvest infestation. However, individuals of some species may be capable of completing their life cycles in the new environment of reduced moisture content. And, if favourable moisture conditions are re-established, many fungi and nematodes and some insect species may be capable of continuing their life cycles.

[141] It should be noted that there are no harmonized time-temperature regimes for kiln-drying.

[142] **2.2.6 Air-drying**

[143] Compared with kiln-drying, air-drying untreated sawn wood reduces wood moisture only to ambient moisture conditions and is therefore less effective against a broad range of pests. The residual pest risks depend on the duration of drying and on the moisture content and intended use of the wood. However, moisture reduction through air-drying alone should not be considered a phytosanitary treatment.

[144] Although moisture reduction through air-drying or kiln-drying alone may not be a comprehensive phytosanitary treatment, wood commodities dried to below the fibre saturation point, which varies for different wood species, are unsuitable for colonization by many pests. The likelihood of infestation of dried wood is very low for many pests.

[145] **2.2.7 Irradiation**

[146] Guidance on irradiation as a phytosanitary measure is provided in ISPM 18:2003. The exposure of wood to various doses of ionizing radiation (e.g. accelerated electrons, x-rays, gamma rays) is sufficient to kill, sterilize or inactivate pests. Appropriate doses of irradiation have the potential to control all wood pests in all wood commodities.

[147] **2.2.8 Modified atmosphere treatment**

[148] Modified atmosphere treatments may be applied to round wood, sawn wood, wood chips and bark.

[149] Wood can be exposed to modified atmospheres (e.g. low oxygen, high carbon dioxide) for extended periods of time to kill or inactivate pests. Modified atmospheres can be artificially generated in gas chambers or allowed to occur naturally during, for instance, water storage or when the wood is wrapped in airtight plastic.

[150] **2.3 Chipping**

[151] Wood chips are prepared on an industrial scale for pulp production, fuel and mulch.

[152] The mechanical action of chipping or grinding wood can be effective in destroying most wood-dwelling pests. Reducing the chip size to a maximum of 3 cm in at least two dimensions significantly improves the effectiveness of chipping in managing pests. Some wood-boring beetles, wood-boring moths and wood-boring wasps, for example, are unlikely to be present on chips of that size with or without bark. However, fungi, nematodes and small insects such as some Scolytinae may not be destroyed by the chipping process.

[153] **2.4 Inspection and testing**

[154] Inspection for the detection of specific wood pests may be used as part of an integrated approach to managing pests in wood. Depending on the wood commodity, inspection can identify specific signs or symptoms of pests. For example, inspection and testing may detect the presence of bark beetles, wood borers and decay fungi on round wood and sawn wood: bark beetle damage, evidence of tunnelling, voids in the wood, or the presence of discoloured or soft areas in the wood could be used as a trigger to further search for live stages of quarantine pests and other ways in which the wood is non-compliant (e.g. the presence of bark). The efficacy of inspection in detecting wood pests is substantially limited by the sometimes large volumes (up to entire shiploads) of wood that may be moved through the production process or as a single consignment.

[155] Guidance on inspection is provided in ISPM 23:2005 and ISPM 31:2008.

[156] **2.5 Pest free areas and pest free places of production**

[157] Pest free areas (ISPM 4:1995; ISPM 8:1998; ISPM 29:2007) and pest free places of production (ISPM 10:1999) may be applied to manage pests associated with all wood commodities. However, the use of pest free places of production may be limited to specific situations such as forest plantations located within agricultural or suburban areas and may not be applicable to most commercial forestry situations.

[158] **2.6 Areas of low pest prevalence**

[159] Biological controls may be used in achieving the requirements for an area of low pest prevalence.

[160] Areas of low pest prevalence (ISPM 8:1998; ISPM 22:2005; ISPM 29:2007) may be used in controlling all pests and potentially used with all wood commodities.

[161] **2.7 Systems approaches**

[162] Pest risks may be managed effectively by developing systems approaches that integrate measures for pest risk management in a defined manner (ISPM 14:2002). Existing forest management systems, both pre- and post-harvest, may be integrated in a systems approach as an option for pest risk management.

[163] Some pest risks associated with round wood (in particular those of deep wood borers and certain nematodes) are difficult to manage through the application of a single phytosanitary measure. In these situations, a combination of phytosanitary measures in a systems approach is one of the options for pest risk management.

[164] The incidence of pests associated with round wood moved in trade may be managed through the establishment of an agreed period in which dispatch of a consignment may occur (e.g. during a period when the pest is inactive). Additional requirements may be established for processing the commodity, once received, within a time frame and in a manner that prevents spread and establishment of the pest.

[165] For example, round wood with bark that may harbour bark beetles of quarantine concern may be permitted to enter the importing country only during a period when the bark beetles are not active. Processing in the importing country to remove the pest risk would be required to occur before individuals develop to the active

stage. Requirements that the wood be debarked and the bark used as a biofuel or otherwise destroyed before the active period of the beetles could be used to sufficiently prevent the risk of introduction and spread of the bark beetles.

[166] In the above case, pre-export or post-entry inspection or the establishment of areas of low pest prevalence may further reduce the pest risk.

[167] The pest risks associated with fungi may be managed effectively through the application of appropriate harvesting measures (e.g. visual selection of wood free of decay) and the application of a surface fungicide.

[168] Biological control and other pest management strategies that significantly reduce pest populations may be used in the establishment of areas of low pest prevalence and subsequently be recognized as a phytosanitary measure.

[169] **3. Intended Use**

[170] The intended use of a wood commodity may affect its pest risk, as some intended uses (e.g. round wood as firewood, wood chips as biofuel or for horticulture) may allow for the introduction and spread of regulated pests (ISPM 32:2009). Therefore, intended use should be considered for improving the management of pests that may not be controlled through the application of phytosanitary measures.

[171] **4. Specific Requirements**

[172] **4.1 Verification of phytosanitary measures**

[173] Verification of application or the actual effect of phytosanitary measures may occur both before export and at the point of entry. ISPM 20:2004, ISPM 23:2005 and ISPM 31:2008 provide comprehensive guidance on inspection and sampling.

[174] As many wood pests are specific to particular tree species or genera, phytosanitary import requirements are often accordingly specific. Therefore, verification of the wood species should be undertaken to determine that the consignment complies with phytosanitary import requirements.

[175] Where inspection is undertaken it should identify any signs or symptoms of live quarantine pests. These may include the fresh frass of insects, living life stages of insects (e.g. egg masses, pupae), galleries or tunnels of wood borers, staining on the surface of the wood caused by fungal organisms, and voids or signs of wood decay. Wood decay includes bleeding cankers; long discontinuous brown streaks on outer sapwood and outer sapwood discoloration; unexplained swelling; resin flow on logs; and cracks, girdling and wounds in sawn wood. Where bark is present it may be peeled back to look for signs of insect feeding and galleries, and for staining or streaking of the wood underneath, which may indicate the presence of pests. Further examination should be made to verify whether live quarantine pests are present. Detection methods such as acoustic and sensory detection may also be used.

[176] Testing may be used to verify the application or effect of phytosanitary measures. Testing may be applied to all wood commodities but is generally limited to the detection of fungi and nematodes. For example, determination of the presence of nematodes of quarantine concern can be made using a combination of microscopy and molecular techniques on small samples of wood taken from consignments.

[177] **4.1.1 Verification of bark removal**

[178] The NPPO of the exporting country should verify compliance with any bark tolerances specified by the NPPO of the importing country.

[179] Where NPPOs require that wood be bark free, the commodity should not have any visible indication of bark except for ingrown bark around knots and bark pockets around annual growth. In many cases, this wood may have evidence of cambium, which may appear as a brown discoloured tissue on the surface of the wood, but this should not be considered as the presence of bark and does not pose a risk for pests associated with bark. In general, verification of bark-free wood should simply confirm that there is no

evidence of the layer of tissue above the cambium.

[180] **4.1.2 Verification of other treatment applications**

[181] Treatments may be verified by the NPPO through documentary checks or treatment-dependent marker labels or tags. Specific tools (e.g. electronic thermometers, gas chromatographs, moisture meters connected to recording equipment) may also be used to verify treatment application. Chemical pressure impregnation and chemical diffusion may leave specific colour stains on the surface of the wood. Depending on the treatment applied, only evidence of live pests (e.g. living life stages, fresh frass) should be considered as non-compliance.

[182] **4.2 Non-compliance**

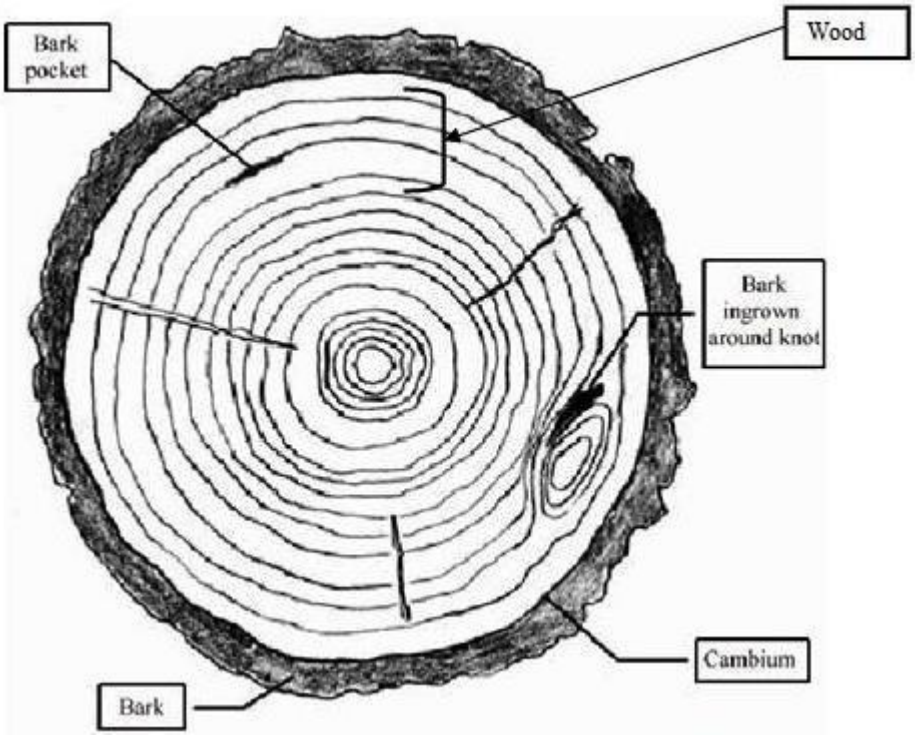
[183] Relevant information on non-compliance and emergency action is provided in ISPM 20:2004 and ISPM 13:2001. The presence of live pests on or in treated wood may be an indication of the failure of the treatment or that the treatment has not been applied. Pests present on the surface of treated wood may be contaminating pests not necessarily originating in the wood's country of origin. The NPPO of the importing country should notify the NPPO of the exporting country in cases where live quarantine pests are found. NPPOs are also encouraged to notify other relevant cases of non-compliance as specified in section 4.1 of ISPM 13: 2001.

[184] This appendix is for reference purposes only and is not a prescriptive part of the standard.

[185] **APPENDIX 1: Cross-sections of wood**

[186] A drawing and photographs of a cross-section of round wood are provided below to better differentiate wood from bark.

[187]



[188]