



Food and Agriculture
Organization of the
United Nations



International Plant Protection Convention
Protecting the world's plant resources from pests

INTERNATIONAL STANDARD FOR PHYTOSANITARY MEASURES 28

PHYTOSANITARY TREATMENT

ISPM 28
ANNEX 23

ENG

PT 23: Sulfuryl fluoride fumigation treatment for nematodes and insects in debarked wood

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ISPM 28

Phytosanitary treatments for regulated pests

PT 23: Sulphuryl fluoride fumigation treatment for nematodes and insects in debarked wood

Adopted 2017; published 2017

Scope of the treatment

This treatment describes the fumigation of debarked wood using sulphuryl fluoride to reduce the risk of introduction and spread of *Bursaphelenchus xylophilus* and insect pests¹.

Treatment description

Name of treatment	Sulphuryl fluoride fumigation treatment for nematodes and insects in debarked wood
Active ingredient	Sulphuryl fluoride (also known as sulfuryl fluoride, sulphur dioxide difluoride, sulphuryl difluoride)
Treatment type	Fumigation
Target pests	Wood-borne life stages of <i>Bursaphelenchus xylophilus</i> (Steiner & Buhrer, 1934) Nickle, 1970 (Nematoda: Aphelenchoididae) and insects, including <i>Anoplophora glabripennis</i> (Motschulsky, 1853) (Coleoptera: Cerambycidae), <i>Anobium punctatum</i> (De Geer, 1774) (Coleoptera: Anobiidae) and <i>Arhopalus tristis</i> (Fabricius, 1787) (Coleoptera: Cerambycidae)
Target regulated articles	Debarked wood not exceeding 20 cm in cross-section at its smallest dimension and 75% moisture content (dry basis)

Treatment schedule

Fumigation of debarked wood not exceeding 20 cm in cross-section at its smallest dimension and 75% moisture content (dry basis) in accordance with a schedule that achieves the minimum concentration–time product (CT) within a single 24 or 48 hour period at the temperature and final residual concentration specified in Table 1.

¹ The scope of phytosanitary treatments does not include issues related to pesticide registration or other domestic requirements for contracting parties' approval of treatments. Treatments adopted by the Commission on Phytosanitary Measures may not provide information on specific effects on human health or food safety, which should be addressed using domestic procedures before contracting parties approve a treatment. In addition, potential effects of treatments on product quality are considered for some host commodities before their international adoption. However, evaluation of any effects of a treatment on the quality of commodities may require additional consideration. There is no obligation for a contracting party to approve, register or adopt the treatments for use in its territory.

Table 1. Minimum concentration–time product (CT) within a single 24 or 48 hour period for debarked wood fumigated with sulphuryl fluoride

Temperature	Duration (hours)	Minimum required CT (g·h/m ³)	Minimum concentration (g/m ³)
20 °C or above	48	3 000	29
30 °C or above	24	1 400	41

This treatment schedule is effective against all wood-borne life stages of nematode and insect pests. There is 95% confidence that the treatment according to this schedule achieves the following levels of mortality for the wood-borne life stages of the following nematode and insect pests:

- *Bursaphelenchus xylophilus* to not less than 99.99683%
- *Anoplophora glabripennis* (larvae and pupae) to not less than 99.99683%²
- *Anobium punctatum* (all life stages) to not less than 99.7462%
- *Arhopalus tristis* (all life stages) to not less than 99%.

The measured temperature of the product (including at the wood core) or the ambient air (whichever is lower) is used to calculate the sulphuryl fluoride dose and must be at least 20 °C throughout the duration of the treatment.

Other relevant information

One example of a schedule that achieves the minimum required CT for debarked wood treated with sulphuryl fluoride is shown in Table 2.

Table 2. Example of a treatment schedule that achieves the minimum required concentration–time product (CT) for debarked wood treated with sulphuryl fluoride (SF)

Minimum temperature during treatment	Minimum required CT (g·h/m ³)	SF dose [†] (g/m ³)	Minimum concentration (g/m ³) at hour:						
			0.5	2	4	12	24	36	48
20 °C or above	3 000	120	124	112	104	82	58	41	29
30 °C or above	1 400	82	87	78	73	58	41	n/a	n/a

[†] Initial doses may need to be higher in conditions of high sorption or leakage.

n/a, not applicable.

The Technical Panel on Phytosanitary Treatments based its evaluation of this treatment for *B. xylophilus* and insects on the research reported by Barak *et al.* (2006), Bonifacio *et al.* (2013) and Sousa *et al.* (2010, 2011).

The general effectiveness of this treatment has been supported by Barak *et al.* (2010), Binker *et al.* (1999), Bonifacio *et al.* (2013), Ducom *et al.* (2003), Dwinell *et al.* (2005), La Fage *et al.* (1982), Mizobuchi *et al.* (1996), Osbrink *et al.* (1987), Soma *et al.* (1996, 1997, 2001), Williams and Sprengel (1990) and Zhang (2006).

² The minimum level of mortality achieved by the treatment for this species has been estimated by extrapolation from a model fitted to the experimental data.

If the CT is not achieved within a single 24–48 hour period (even if the minimum concentration is achieved), corrective action will need to be taken. The treatment may be extended for a maximum of two hours without adding more sulphuryl fluoride, or it may be restarted.

References

The present annex to the standard may refer to International Standards for Phytosanitary Measures (ISPMs). ISPMs are available on the International Phytosanitary Portal (IPP) at <https://www.ippc.int/core-activities/standards-setting/ispms>.

- Barak, A., Messenger, M., Neese, P., Thoms, E. & Fraser, I.** 2010. Sulphuryl fluoride treatment as a quarantine treatment for emerald ash borer (Coleoptera: Buprestidae) in ash logs. *Journal of Economic Entomology*, 103(3): 603–611.
- Barak, A., Wang, Y., Zhan, G., Wu, Y., Xu, L. & Huang, Q.** 2006. Sulphuryl fluoride as a quarantine treatment for *Anoplophora glabripennis* (Coleoptera: Cerambycidae) in regulated wood packing material. *Journal of Economic Entomology*, 99(5): 1628–1635.
- Binker, G., Binker, J., Fröba, G., Graf, E. & Lanz, B.** 1999. Laboratory study on *Anobium punctatum*, number 130377/A and 403972 (bioassay 11–15), unpublished, Binker Materialschutz, Germany. In: *Inclusion of active substances in Annex I to Directive 98/8/EC: Assessment report: Sulphuryl fluoride, PT8, Appendix IV (List of studies)*, p. 29, September 2006.
- Bonifacio, L., Inácio, M.L., Sousa, E., Buckley, S. & Thoms, E.M.** 2013. *Complementary studies to validate the proposed fumigation schedules of sulphuryl fluoride for inclusion in ISPM No. 15 for the eradication of pine wood nematode (Bursaphelenchus xylophilus) from wood packaging material*. Report. Lisbon, Instituto Nacional de Investigação Agrária e Veterinária (ex-INRB). 60 pp.
- Ducom, P., Roussel, C. & Stefanini, V.** 2003. Efficacy of sulphuryl fluoride on European house borer eggs, *Hylotrupes bajulus* (L.) (Coleoptera: Cerambycidae), contract research project. Laboratoire National de la Protection des Végétaux, Station d'Etude des Techniques de fumigation et de Protection des Denrées Stockées, Chemin d'Artigues - 33150 Cenon, France. In: *Inclusion of active substances in Annex I to Directive 98/8/EC: Assessment report: Sulphuryl fluoride, PT8, Appendix IV (List of studies)*, p. 31, September 2006.
- Dwinell, L.D., Thoms, E. & Prabhakaran, S.** 2005. Sulphuryl fluoride as a quarantine treatment for the pinewood nematode in unseasoned pine. In: *Proceedings of the 2005 Annual International Research Conference on Methyl Bromide Alternatives and Emissions Reduction*. San Diego, CA, 31 October–3 November 2005, pp. 1–12. Fresno, CA, Methyl Bromide Alternatives Outreach.
- La Fage, J.P., Jones, M. & Lawrence, T.** 1982. A laboratory evaluation of the fumigant, sulphuryl fluoride (Vikane), against the Formosan termite *Coptotermes formosanus* Shiraki. International Research Group on Wood Protection (IRGWP) Thirteenth Annual Meeting. Stockholm, May 1982. Stockholm, IRGWP Secretariat.
- Mizobuchi, M., Matsuoka, I., Soma, Y., Kishino, H., Yabuta, S., Imamura, M., Mizuno, T., Hirose, Y. & Kawakami, F.** 1996. Susceptibility of forest insect pests to sulphuryl fluoride. 2. Ambrosia beetles. *Research Bulletin of the Plant Protection Service Japan*, 32: 77–82.
- Osbrink, W.L.A., Scheffrahn, R.H., Su, N.-Y. & Rust, M.K.** 1987. Laboratory comparisons of sulphuryl fluoride toxicity and mean time of mortality among ten termite species (Isoptera: Hodotermitidae, Kalotermitidae, Rhinotermitidae). *Journal of Economic Entomology*, 80: 1044–1047.
- Soma, Y., Mizobuchi, M., Oogita, T., Misumi, T., Kishono, H., Akagawa, T. & Kawakami, F.** 1997. Susceptibility of forest insect pests to sulphuryl fluoride. 3. Susceptibility to sulphuryl fluoride at 25 °C. *Research Bulletin of the Plant Protection Service Japan*, 33: 25–30.
- Soma, Y., Naito, H., Misumi, T., Mizobuchi, M., Tsuchiya, Y., Matsuoka, I., Kawakami, F., Hirata, K. & Komatsu, H.** 2001. Effects of some fumigants on pine wood nematode,

- Bursaphelenchus xylophilus* infecting wooden packages. 1. Susceptibility of pine wood nematode to methyl bromide, sulfuryl fluoride and methyl isothiocyanate. *Research Bulletin of the Plant Protection Service Japan*, 37: 19–26.
- Soma, Y., Yabuta, S., Mizoguti, M., Kishino, H., Matsuoka, I., Goto, M., Akagawa, T., Ikeda, T. & Kawakami, F.** 1996. Susceptibility of forest insect pests to sulfuryl fluoride. 1. Wood borers and bark beetles. *Research Bulletin of the Plant Protection Service Japan*, 32: 69–76.
- Sousa, E., Bonifácio, L., Naves, P., Lurdes Silva Inácio, M., Henriques, J., Mota, M., Barbosa, P., Espada, M., Wontner-Smith, T., Cardew, S., Drinkall, M.J., Buckley, S. & Thoms, M.E.** 2010. *Studies to validate the proposed fumigation schedules of sulfuryl fluoride for inclusion in ISPM No. 15 for the eradication of pine wood nematode (Bursaphelenchus xylophilus) from wood packaging material.* Report. Lisbon, Instituto Nacional de Investigação Agrária e Veterinária (ex-INRB). 20 pp.
- Sousa, E., Naves, P., Bonifácio, L., Henriques, J., Inácio, M.L. & Evans, H.** 2011. Assessing risks of pine wood nematode *Bursaphelenchus xylophilus* transfer between wood packaging by simulating assembled pallets in service. *EPPO Bulletin*, 41: 423–431.
- Williams, L.H. & Sprengel, R.J.** 1990. Ovicidal activity of sulfuryl fluoride to anobiid and lyctid beetle eggs of various ages. *Journal of Entomological Science*, 25(3): 366–375.
- Zhang, Z.** 2006. Use of sulfuryl fluoride as an alternative fumigant to methyl bromide in export log fumigation. *New Zealand Plant Protection*, 59: 223–227.

Publication history

This is not an official part of the standard

2006-04 CPM-1 (2006) added topic *Revision of ISPM 15 (Regulation of wood packaging material in international trade)* (2006-011).

2006-09 Treatment submitted in response to 2006-08 call for treatments.

2006-12 TPPT reviewed treatment.

2007-07 Revised draft considered by TPFQ.

2007-12 Further revised draft submitted to TPPT.

2008-12 TPFQ discussion.

2009-01 TPPT reviewed draft.

2009-07 Amended draft considered by TPFQ.

2010-07 Draft updated and recommended to SC.

2010-09 TPFQ discussion.

2011-04 SC e-decision.

2011-05 SC via e-discussion returned to TPPT.

2011-07 TPPT revised draft based on SC comments.

2011-10 TPPT reviewed draft.

2012-02 TPFQ discussion.

2012-12 TPPT reviewed draft.

2013-07 TPPT reviewed draft based on additional information from Submitter.

2014-01 TPPT deferred draft review pending information from specialists.

2014-06 TPPT reviewed draft based on information from specialists; TPPT recommended topic *Sulphuryl fluoride fumigation of wood packaging material* (2007-101) be split into two topics (one for insects and one for nematodes and insects); TPPT recommended draft to SC for member consultation.

2014-09 SC approved draft for member consultation via e-decision (2014_eSC_Nov_09).

2014-11 SC agreed to split *Sulphuryl fluoride fumigation of wood packaging material* (2007-101) into two topics: *Sulphuryl fluoride fumigation of insects in debarked wood* (2007-101A) and *Sulphuryl fluoride fumigation of nematodes and insects in debarked wood* (2007-101B).

2015-07 First consultation.

2016-09 TPPT recommended to SC for adoption.

2016-11 SC recommended to CPM-12 for adoption via e-decision (2016_eSC_Nov_16).

2017-04 CPM-12 adopted the phytosanitary treatment.

ISPM 28. Annex 23. *Sulphuryl fluoride fumigation treatment for nematodes and insects in debarked wood* (2017). Rome, IPPC, FAO.

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IPPC

The International Plant Protection Convention (IPPC) is an international plant health agreement that aims to protect cultivated and wild plants by preventing the introduction and spread of pests. International travel and trade are greater than ever before. As people and commodities move around the world, organisms that present risks to plants travel with them.

Organization

- ◆ There are over 180 contracting parties to the IPPC.
- ◆ Each contracting party has a national plant protection organization (NPPO) and an Official IPPC contact point.
- ◆ Nine regional plant protection organizations (RPPOs) work to facilitate the implementation of the IPPC in countries.
- ◆ IPPC liaises with relevant international organizations to help build regional and national capacities.
- ◆ The Secretariat is provided by the Food and Agriculture Organization of the United Nations (FAO).

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