

APPENDIX L: DATA REQUIREMENT GUIDELINES FOR LISTING CHEMICALLY MODIFIED WOOD WITH ENHANCED DURABILITY IN THE AWPA STANDARDS

Maintained by Technical Committee P-9

This Appendix to AWPA's Technical Committee Regulations is not an AWPA Standard. It is a non-mandatory guidelines document presented to enable the user to understand the basic testing requirements for wood protection systems and to assist the AWPA Technical Committees in the development of AWPA Standards. The testing of products in accordance with this Appendix does not constitute conformance with any AWPA Standard. No product can be considered to conform with an AWPA Standard until it has been subjected to complete technical review and voting by AWPA's Technical Committees, and procedural review and final action by the AWPA Executive Committee pursuant to the AWPA Technical Committee Regulations.

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1. GENERAL INFORMATION AND PURPOSE

Chemically modified woods with enhanced durability are listed in the AWPA Standards by means of a proposal and supporting data package submitted to the appropriate AWPA Technical Committee, followed by a discussion and voting process. The complete listing procedure is outlined in the AWPA Technical Committee Regulations. A similar procedure is followed to expand the applications for a listed treatment or modify the composition of a treatment system already listed in the AWPA Standards. The purpose of this Appendix is to guide proponents in the type of data to be included in a supporting data package to propose listing a new chemically modified wood with enhanced durability or modify the listing of an existing one. A proponent should be familiar with the AWPA Use Category System (UCS). Refer to the AWPA Book of Standards for information on the UCS. For more specific guidance on preservative standardization, proposal sponsors are encouraged to interact with the appropriate Technical Committees early in the preservative evaluation process. This can be initiated by asking Association Staff (see www.awpa.com for contact information) for the appropriate Technical Committee Chair to contact.

This document suggests certain data requirements for consideration of chemically modified woods with enhanced durability or modifications to the listing of such systems. While the proponent of a system is expected to provide all data suggested by this document, it is understood that it may not be possible to develop one or more types of data in some cases. In the event listed data is not submitted, the proponent shall provide justification for not doing so. Notwithstanding the statements in this document, the appropriate Technical Committee shall be the final arbiter of the type, quantity, and validity of the data needed for the listing of a system. For chemically modified woods, it is important to recognize that historical acceptance criteria (e.g. weight loss of <5%) may not be valid. In other cases, rating systems may have to be adapted to the specific modifications. Thus, the burden of consideration for the Technical Committee may be quite large and difficult.

The format of the AWPA Standard may also need to be altered from the usual one to allow for the particular

modification system. A proponent is cautioned to maintain as much similarity as possible in proposing a standard for a modification system.

It may not be appropriate to express retention for chemically modified woods using traditional units such as pounds per cubic foot. As well, it may not be possible to use traditional chemical analysis methods such as XRF for determining retention for chemically modified woods. Therefore, the proponent is cautioned to provide a fully developed analytical procedure for use on the modified wood and to provide details for stating the retention in whatever terminology is appropriate. The various tests submitted for consideration should show an efficacy dependence on retention similar to that of typical chemical active ingredients.

After standardization of a new modification system, the proponents shall provide yearly data updates to the appropriate Technical Committee on critical field tests for a period of five years. Standards are then reaffirmed at 5 year intervals (see Appendix I of the AWPA Technical Committee Regulations).

2. TYPES OF PROPOSALS

These guidelines cover three types of wood modification system proposals:

Type 1 - Listing of a new chemically modified wood in the AWPA Standards; or making a major change to a previously standardized modified wood. Examples of major changes are radically altering the modification chemistry such that the product has significantly different performance attributes.

Type 2 - Listing an AWPA standardized chemically modified wood in a new use category or categories.

Type 3 - Minor alteration(s) to an AWPA standardized chemically modified wood. An example of a minor alteration would be changes in ratios of modifying agents in multi-component systems.

The distinction between major and minor alterations (*Type 1* and *Type 3* proposals) may be unclear at times. A proponent is encouraged to interact with the appropriate AWPA Technical Committee for guidance on how to classify a proposal (see Section 1, above).

Additives are not normally considered during the modification review process. It is the responsibility of the proponent to fully document the modification process and identify any additives, if present.

3. HOW TO USE THESE GUIDELINES

To use these guidelines, the proponent should:

1. Determine what type of proposal is being considered (see Section 2 of this Appendix).
2. Decide in what Use Categories the modified wood product will be used (see Section 2 of Standard U1 for descriptions of the different Use Categories).
3. Determine what other information should be included in the proposal and data package by referring to Section 4 of this Appendix.
4. Depending on the proposal type and Use Categories of interest, determine the recommended performance data necessary by referring to Table 1 of this Appendix. This Table is used in conjunction with Section 5, Methodology for Generating Performance Data, which describes the individual data guidelines in more detail.

4. GUIDELINES FOR ALL SUBMISSIONS

4.1 Information Suggested for All *Type 1* Submissions – All *Type 1* proposals should include the following information:

4.1.1 Proposed wording for the modification listing in the appropriate Standard. The proponent should model the proposed wording on what is currently used in the relevant Standard.

4.1.2 Listing of the proposed Use Categories and corresponding level of modification necessary for the use category.

4.1.3 Chemical and physical properties of the chemically modified wood. Pertinent information on the chemical and physical properties shall be provided. Particular emphasis should be placed on chemical and thermal stability since these factors may have an effect on the long term performance. It may be helpful to discuss by-products or residuals as well. Examples of relevant chemical and physical properties are: density and hydrolytic stability.

4.1.4 EPA registration status. A proposal to list a modification system can be made while that preservative is still in the EPA registration process or in negotiation with the EPA as to its classification, but standardization cannot occur until registration or classification is complete (see Section 7.5.7 of the AWPA Technical Committee Regulations).

4.1.5 MSDS(s) for the modified wood.

4.1.6 Methods for determination of:

- A. Level of modification of wood as quantitative measurement.

B. Penetration gradient of the modification throughout the wood.

4.1.7 Treatability. At a minimum, information on the penetration and resulting gradient resulting from laboratory, pilot production or manufacturing facility treatment of southern pine sapwood (or other substrate for which the chemical modification is proposed) with the proposed wood modification system or process shall be provided.

4.1.8 Performance data as specified in Table 1 and Section 5.

4.2 Information Suggested for All Type 2 Submissions – All Type 2 proposals should include information as listed in Section 4.1.1, 4.1.2 and 4.1.8 above.

4.3 Information Suggested for All Type 3 Submissions – All Type 3 proposals should include information as listed in Section 4.1.3, 4.1.4, 4.1.5, 4.1.6 and 4.1.8 above.

4.4 Use of Control Treatments – All evaluations of chemically modified wood performance should include comparative information from untreated wood controls and at least one AWPA-listed preservative system with a commercial history of use in the same Use Category or Categories as the proposed system. Comparison to two listed wood preservatives is recommended.

4.5 Wood Species – If the modification system or process is intended for use with softwoods, southern pine sapwood is preferred for performance evaluations. If the modification system or process is to be used with hardwoods, representative species for the proposed commercial application(s) should be used for evaluating the performance of the product.

4.6 Test Retentions – Choosing levels of modification to be evaluated in performance tests is a critical part of the experimental design. It is desirable to include modification levels at or close to the projected commercial use levels of the product. For tests that evaluate the fungal and insect resistance of the preservative, it is highly desirable to include levels that bracket the performance threshold. See AWPA Standard E7, Section 6.4 for additional general guidance.

5. METHODOLOGY FOR GENERATING PERFORMANCE DATA

This section describes the performance testing requirements listed in Table 1 in more detail and gives some example methods to obtain the performance data. Standard test methods are not available for evaluating all of the performance criteria. Whenever standard methods are not available, nonstandard methods are suggested. Use of methods other than those suggested (or modified suggested methods) may also be acceptable provided they are based on sound experimental principles. A decision on the acceptability of

data generated by new or modified test methods will be made by the particular AWPA Technical Committee that has jurisdiction over listing the proposed modification system, product, or process. The name of the institution or company which performed the test should be stated. The use of third-party testing labs and agencies for critical tests is recommended.

The final decision on whether the data package supports the proposed modification system, product, or process lies with the appropriate Technical Committee. Data substitutions, for example long term field studies may preclude the necessity for certain accelerated laboratory testing, may be allowed by the Technical Committee. Allowing such data substitutions is the prerogative of the Technical Committee. Guidance on such issues can be obtained from the appropriate Technical Committee Chair. Contact information can be obtained from Association Staff (found at www.awpa.com).

5.1 Wood Preservative Efficacy

This section refers to anti-fungal and anti-insect performance properties of the chemically modified wood.

5.1.1 Laboratory Efficacy

5.1.1.1 Soil Block

Preferred Method: AWPA E10, *Standard Method of Testing Wood Preservatives by Laboratory Soil-block Cultures*, or AWPA E22, *Standard Accelerated Laboratory Method for Testing the Efficacy of Preservatives Against Wood Decay Fungi Using Compression Strength*.

The soil block test is the most commonly used lab method for evaluating the performance of wood preservatives against basidiomycete wood decay fungi. The experiment should be designed to bracket the expected performance threshold of the level of modification, and also include levels at, or close to, the proposed use levels.

Data from a minimum of three basidiomycete species is suggested. If the wood preservative is intended for use in softwoods, three brown rot species should be used. For preservatives to be used in hardwoods, three white rot species should be used. If the modification is intended to be used in both softwoods and hardwoods, data from three of each fungal type should be provided. Consult E10 or E22 for guidance on selection of fungal species and strains.

5.1.1.2 Soft Rot

Preferred Methods: Modified AWPA E14, *Standard Method of Evaluating Wood Preservatives in a Soil Bed*, or AWPA E23, *Accelerated Method of Evaluating Wood Preservatives in Soil Contact*.

E14 can be modified for soft rot testing through the use of smaller test specimen sizes (e.g. 3 mm x 14 mm x 150 mm)

and maintaining the soil water holding capacity (WHC) at $150\% \pm 10\%$ minimum. Ratings should be performed visually or utilizing a modified Modulus of Elasticity (MOE) test apparatus to measure static MOE as per E23 which uses MOE measurements.

5.1.1.3 Termite

Preferred Method: AWPA E1, *Standard Method for Laboratory Evaluation to Determine Resistance to Subterranean Termites*.

Termites are very sensitive to volatiles in this type of small-container lab test. Care should be taken to include suitable solvent and carrier controls, and weather the blocks appropriately. The eastern subterranean termite (*Reticulitermes flavipes*) should be used as the test organism. Tests with the Formosan subterranean termite (FST, *Coptotermes formosanus*) shall be done if the modification system will be used in regions where this insect is present. If such data is not provided, recommendation for use of the product in FST regions cannot be provided.

5.1.1.4 Soil Bed

Preferred Methods: AWPA E14, *Standard Method of Evaluating Wood Preservatives in a Soil Bed*; AWPA E23, *Accelerated Method of Evaluating Wood Preservatives in Soil Contact*.

The test methods accommodate some exposure variability. Soil physical characteristics, average soil moisture content as expressed as a percentage of the water holding capacity, and bin maintenance procedures (soil replacement, etc.) shall be reported.

5.1.2 Field Testing

For all field tests it is recommended to include a current benchmark product such as ACQ or Copper Azole treated wood for comparison.

5.1.2.1 Field Stake

Preferred Method: AWPA E7, *Standard Method of Evaluating Wood Preservatives by Field Tests with Stakes*.

Data from a minimum of two geographically separated test sites are suggested. These sites should be selected so that they provide two distinctly different climates and soil types. In known high decay hazard areas (e.g. Gulf Coast region and windward Hawaii) the minimum suggested exposure time is three years, provided that field depletion data from the same site over the same time period is also included (Section 5.2.2.1). For areas of lower decay hazard (e.g. Wisconsin), or if depletion data over the same exposure period is not available, longer exposure times are suggested. In these cases,

the Technical Committee evaluating the proposal will determine whether the length of exposure time is adequate.

5.1.2.2 Posts

Preferred Method: AWPA E8, *Standard Method for Field Tests with Posts*.

Treated post evaluation is recommended when the modification system or process is to be used in roundwood commodities.

5.1.2.3 Above-Ground

Preferred Methods: AWPA Standards E9, *Standard Field Test for the Evaluation of Wood Preservatives to be used in Non-Soil Contact*; E16, *Standard Field Test for Evaluation of Wood Preservatives to be used Out of Ground Contact: Horizontal Lap-Joint Method*; or E18, *Standard Field Test for Evaluation of Wood Preservatives Intended for Use Category 3B Applications, Exposed, Out of Ground Contact, Uncoated Ground Proximity Decay Method*.

E9 was designed for evaluating millwork preservatives. E16 and the Ground Proximity method are more general tests. In known high above-ground decay rate climates (e.g. windward Hawaii) the suggested minimum exposure time is three years, provided that field depletion data from the same site over the same time period is also included (Section 5.2.2.2). For areas of lower above-ground decay hazard (e.g. Gulf Coast states), or if depletion data over the same exposure period is not available, longer exposure times are suggested. In these cases, the Technical Committee evaluating the proposal will determine whether the length of exposure time is adequate.

5.1.2.4 Termite

Preferred Method: AWPA E21-09 *Standard Test Method for the Evaluation of Preservative Treatments for Lumber and Timbers against Subterranean Termites in Above-Ground, Protected Applications (UC1 and UC2)*.

A minimum of two years exposure is suggested. Substantial attack of untreated controls should be observed at the end of the test exposure time. At a minimum, testing should be done with the Eastern subterranean termite (*Reticulitermes flavipes*). If the preservative system will be used in regions where the Formosan subterranean termite (FST, *Coptotermes formosanus*) is present, testing with this insect shall be done as well. If such data is not provided, recommendation for use of the preservative in FST regions cannot be provided.

E7 field stake data from a field site with apparent high termite activity may be used to substitute for data from a termite-specific test method as described above.

5.1.2.5 Marine Panels

Preferred Method: AWP A E5, *Standard Test Method for Accelerated Evaluation of Wood Preservatives for Marine Services by Means of Small Size Specimens* (Type A or B panels)

Test sites should be chosen based on the proposed marine Use Category application(s). See Standard U1, Section 2, for the geographical and hazard organism specifications for the 5A, 5B, and 5C Use Categories. Also see Commodity Specification G of Standard U1 for further information. Data from a minimum of two geographically separated test sites are suggested. The suggested minimum exposure time is two years provided that marine depletion data from the same sites over the same time period are also included (Section 5.2.2.3). If depletion data over the same exposure period is not available, longer exposure times are suggested. In these cases, the Technical Committee evaluating the proposal will determine whether the length of exposure time is adequate.

5.2 Wood Preservative Depletion

5.2.1 Laboratory Depletion

5.2.1.1 Water Leach

Preferred Method: AWP A E11, *Standard Method of Determining the Leachability of Wood Preservatives*.

For chemically modified wood proposed for UC5A-C, leaching should be done using natural or artificial seawater.

5.2.1.2 Soil Leach

Preferred Method: AWP A E20, *Standard Method for Determining the Leachability of Wood Preservatives in Ground Contact*.

The level of modification should be compared before and after the soil exposure.

5.2.1.3 Evaporative Aging

Preferred Method: EN 73, *Accelerated aging of treated wood prior to biological testing. Part I: Evaporative aging procedure*.

Evaporative aging is applicable to wood modifications systems where one or more of the ingredients are organic compounds with a significant vapor pressure. Loss of this type of component should be monitored in the test. It may not be necessary to generate evaporative aging data on ingredients with little or no volatility at typical exposure conditions.

5.2.2 Field Depletion

5.2.2.1 Field Stakes

Preferred Method: Based on AWP A E7, *Standard Method of Evaluating Wood Preservatives by Field Tests with Stakes*, Section 10

A minimum of three years exposure is suggested from two test sites for the initial proposal data package. A minimum of five replicate depletion stakes should be removed and analyzed after one and three year exposures. Three cross sectional zones (outer, middle, and core) should be cut from a subsample cut from immediately below the stake groundline. In addition, sufficient stakes should be installed initially to allow removal and analysis of stakes after an additional 5 years of exposure (8 years total). Eight year results should be reported to the appropriate Technical Committee at the five year review after standardization.

5.2.2.2 Above-Ground

Preferred Method: Above-ground depletion evaluation should be done using test specimens and exposure identical or similar to test specimens exposed for decay resistance - AWP A Standards E9, E16, or E18.

There are no standardized above-ground field depletion methods. In general, the above-ground field depletion method used should be similar to the method used to evaluate the field biological resistance. In all cases a matched unexposed set of specimens should be analyzed using the same subsampling and analytical methods as the exposed specimens.

Depletion specimens should be installed at the same time that above-ground decay evaluation specimens are installed. A minimum of three years total exposure is suggested from two test sites for the initial proposal data package. A minimum of five replicate depletion specimens should be removed and analyzed after one and three year exposures. The exact geometry of the analytical specimens will depend on the specifications of the exposure specimen. In addition, sufficient depletion specimens should be installed initially to allow removal and analysis of stakes after an additional 2 years of exposure (5 years total).

5.2.2.3 Marine Panels

Preferred Method: Marine depletion evaluation should be done using test specimens and exposure identical or similar to test specimens exposed for durability testing. (AWP A E5 Type A or B panels.)

Depletion specimens should be installed at the same time that marine evaluation specimens are installed. A minimum of two years total exposure is suggested from two test sites for the initial proposal data package. A minimum of five replicate depletion specimens should be removed and analyzed after

one and two year exposures. The analytical subspecimens should be cut from the center region of the exposure panel. In addition, sufficient depletion specimens should be installed initially to allow removal and analysis of stakes after an additional 3 years of exposure (5 years total).

5.3 Effect on Wood Physical Properties

Preferred Methods: The preferred method depends on the type of material being considered. For treated solid wood use general methods of ASTM D 5664-02; for treated composite products use methods of ASTM D 5516-01.

5.3.1 Strength

5.3.1.1 Strength of Solid-wood Products

For chemically modified solid wood products that are NOT intended for any in-service exposure to elevated temperatures (>50C), the preferred method is to follow ASTM D 5664-02 Procedure #1 using small-clear specimens cut from end-matched treated and untreated 2x4's (see section 4.2 of ASTM D5664-02). For chemically modified solid wood products that are intended for an in-service exposure at elevated temperatures (>50C), the preferred method is to follow both ASTM D 5664-02 Procedure#1 and #2 (see section 4.2 and 4.3 of that Standard). Alternatively, ASTM D 5664-02 Procedure #3 which evaluates full-size lumber may be substituted instead for this latter testing requirement.

5.3.1.2 Strength of Composite Wood Products

For composite wood products comprised of chemically modified wood that are NOT intended for any in-service exposure to elevated temperatures (>50C), the preferred method is to follow ASTM D 5516-03 using composite specimens from chemically modified and untreated panels of the appropriate composite as detailed in the D 5516-03 Standard except skipping the requirements of sections 7.1 and 7.2 of D 5516-03 for high-temperature exposure and subsequent testing of that material. For composite wood products comprised of chemically modified wood that are intended for an in-service exposure to elevated temperatures (>50C), the preferred method is to follow all recommendations of ASTM D 5516-03 procedures.

5.3.2 Electrical Conductivity

Preferred Method: See Katz and Miller. 1963. Proc. AWPA, 59, pp. 204-217.
The preferred method is a method for determination of electrical resistance. Other methods that specifically measure conductivity may be used.

5.3.3 Hygroscopicity

Preferred Method: ASTM D3201, *Standard Test Method for Hygroscopic Properties of Fire-Retardant Wood and Wood-Based Products*

Use the general procedures of the preferred method for 14 days at $92 \pm 2\%$ RH.

5.3.4. Fire Properties

Preferred Method: ASTM E1354-97, *Standard Test Method for Heat and Visible Smoke Release Rates for Products Using an Oxygen Consumption Calorimeter*

The preferred method should use a sample dimension of 100 x 100 mm, and a heat flux rate of 50 kW/m². If smoke toxicity is a potential concern for the chemically modified wood under consideration, ASTM E662, *Smoke Generated by Solid Materials* should be performed in conjunction with BSS 7239, *Smoke Toxicity*, measuring the specific gases CO, HF, NO₂, HCl, HCN, and SO₂. Alternatively, ASTM E1678-09, *Standard Test Method for Measuring Smoke Toxicity for Use in Fire Hazard Analysis*, may also be used. A third smoke toxicity protocol is known as the UPITT Method and several laboratories offer this test.

5.4 Corrosivity

5.4.1 Treating Solution

Preferred Method: AWPA E17, *Standard Method for Determining Corrosion Rates of Metals in Contact with Treating Solutions*.

Many new wood modification processes will use purpose-built equipment designed to deal with the known corrosivity of a reactant. As it is the product, not the process that is being listed, this methodology is included here for reference for producers.

5.4.2 Corrosivity of Chemically Modified Wood

Preferred Method: AWPA E12, *Standard Method of Determining Corrosion of Metal in Contact with Treated Wood*.

AWPA E12 is a laboratory test. Field testing of commercial fasteners in the modified wood is also useful. Consult with AWPA Technical Committee P-6 for typical non-standardized fastener/wood field test methods. Additional fastener corrosion tests are available from ISANTA or in ICC-ES AC257.

Table 1. Summary of data suggested in a data package used to support a proposal to list a new wood modification system or process in the AWPA Standards, make major or minor modifications to an AWPA-listed system, or expand the applications for a listed system into new use categories. See Section 5.0 of these Guidelines for further information on test methods.

(M = Mandatory, R = Recommended)

TESTING REQUIREMENTS	Section	UC1	UC2	UC3A	UC3B	UC4A-C	UC5A-C
Wood Modification Efficacy							
Laboratory Efficacy Testing							
Soil Block	5.1.1.1		M	M	M	M	M
Soft-Rot	5.1.1.2					M	M
Termite	5.1.1.3	M	M	M	M	M	M
Soil Bed	5.1.1.4			R	R	R	R
Field Efficacy Testing							
Field Stakes	5.1.2.1			R	R	M	M
Post	5.1.2.2					R	R
Above-Ground	5.1.2.3		M	M	M		
Termite	5.1.2.4	M	M	M	M	M	M
Marine Panels	5.1.2.5						M
Wood Modification Depletion							
Laboratory Depletion Testing							
Water Leach	5.2.1.1		R	M	M	M	M
Soil Leach	5.2.1.2					M	M
Evaporative Aging ^a	5.2.1.3	M	M	M	M	M	M
Field Depletion Testing							
Field Stake	5.2.2.1					M	M
Above-Ground	5.2.2.2		R	M	M		
Marine Panels	5.2.2.3						M
Physical Properties of Modified Wood							
Strength	5.3.1	M	M	M	M	M	M
Electrical Conductivity ^b	5.3.2				M	M	M
Hygroscopicity	5.3.3	M	M	M	M	M	M
Fire Properties	5.3.4	M	M	M	M	M	M
Modification Corrosivity							
Treating Solution ^c	5.4.1						
Modified Wood	5.4.2	M	M	M	M	M	M

^a Evaporative aging is applicable to wood modification systems or processes where one or more of the active ingredients are organic compounds with a significant vapor pressure.

^b This highly recommended test applies only to components of utility line structures and railway ties.

^c The treating solution is often known to be corrosive and data are required only for listing processes, not the product.