GUIDANCE DOCUMENT P: STANDARD PRACTICE FOR DETERMINING MINIMUM EFFICACY THRESHOLDS FOR NEW UC4A PRESERVATIVES

Jurisdiction: Technical Committee P-6

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This document describes standard practices for evaluating and determining minimum efficacy thresholds for preservative systems to be standardized for AWPA Use Category 4A (UC4A) Ground Contact – General Use. Supporting documentation for a new preservative system shall include data to cover all mandatory requirements listed in the AWPA Guidance Document A: Data Requirements for Listing Wood Preservative in the AWPA Standards. This guideline describes how results from those tests listed in Guidance Document A that are specific to biological performance of a preservative should be evaluated to determine the minimum efficacy threshold. Minimum efficacy threshold is defined as the lowest dose or retention of a preservative or preservative combination that protects wood against the actions of specified wood damaging organisms. This data is used by AWPA Subcommittees P3 and P4 to set and recommend minimum preservative retentions to the AWPA T-Committees. The AWPA T-Committees will consider this minimum threshold, as well as other factors including treatment variability, when setting minimum preservative retentions for the commodities under their jurisdiction. AWPA T-Committees, can establish higher, but not lower minimum preservative retentions than those recommended by AWPA Subcommittees P-3 and P-4. All performance data will be evaluated as a whole. The minimum performance requirements listed for individual tests are not necessarily absolute, but represent the minimum performance expected for individual tests to provide support for specific threshold levels or equivalent performance in comparison to established reference preservative systems. This comes into play only when there are multiple data sets covering individual AWPA Guidance Document A requirements.

The supporting data and recommended tests required to evaluate a preservative system are described in Guidance Document A, Sections 5.2 and 5.3, for the appropriate use category of exposure as listed in Table 1 of that document. These tests must take into account the General Considerations described in Section 5.1. Long-term field data will typically carry more weight than laboratory results, but neither can be ignored. With field tests, performance data interpretation will vary depending on how long any individual test has been in place. Field tests with less than 3 years data shall not be considered in establishing minimum efficacy thresholds. Field tests with only 3 to 5 years data will tend to have more stringent data performance requirements to support that the new preservative system in question is performing equivalent to established preservative systems.

The strength of all field data will depend on the relative fungal decay of test systems in relation to untreated controls and reference systems. Unless there is some decay or termite attack in the reference system (at the UC4A retention, or a lower retention), field data may supply strong support that the system is an effective preservative, but it will not provide valid data to determine minimum efficacy thresholds or support a specific minimum retentions. For example, if after 5 years, both the test system and reference systems average "10" (no decay) at "X" and "Y" retentions, this may be strong support for the new system as an effective preservative, but does not provide specific support that the "X" retention will provide equivalent performance to the established reference system over longer exposures. Conversely, if after 5 years these systems at "½" these retentions are both performing equivalently and some decay is present (both averaging ratings at 8.5), this does provide support that the test system can be expected to perform similarly to the established reference system.

5.2.1. UC4A LABORATORY EVALUATIONS

5.2.1.1 Basidiomycete Fungal Decay: Data on the ability of the system to control specific basidiomycete decay fungi are required. The preferred method to generate this data is the AWPA E10 Soil-Block test, although the AWPA E22 is also acceptable, and agar-block tests can provide additional useful information. Testing must use leaching or weathering as required by E10 or E22 based on the type of system being tested. Testing must be conducted on the following 4 mandatory fungi, the brown rots *Neolentinus lepideus, Gloeophyllum trabeum, Postia placenta (Syn. Rhodonia placenta)* (testing in softwood sapwood) and a white-rot, *Irpex lacteus* or *Trametes versicolor* (testing in diffuse-porous hardwood sapwood). Other fungi listed in Section 6 of E10 can also be used in addition to these four mandatory fungi to provide additional support for determining a minimum effective threshold. Acceptable weight losses in untreated controls, as shown in E10 Table 1, must be achieved to establish the decay capacity of fungal isolates. The minimum efficacy threshold should exceed the toxic

threshold established in this test for each of the four mandatory fungi, and preferably with a safety margin. In addition, all UC4A Ground Contact efficacy threshold retentions must perform equivalent to, or better, than the reference system at its standardized UC4A retention for each fungus tested. Minor differences in relative performance may be acceptable for individual fungi if long-term field data are sufficient to support the overall performance of the system.

5.2.1.2 Soft-Rot Fungal Decay: Data are required on the performance of the test system in unsterile soil at high moisture content suitable for soft-rot decay development. The preferred method is AWPA E23, although a modified AWPA E14 Soil-bed Test is also acceptable. These tests should be run until twice the time required for untreated control specimens to reach an average rating of less than 4. The test system at its minimum efficacy threshold is expected to perform the same or better than the reference system at its UC4A targets, although data will only support a specific minimum efficacy threshold if decay has been observed in the reference preservative system. This can be when evaluated at the reference system UC4A retention or at a percentage of the UC4A retention (eg. 50% of the reference UC4A retention compared to 50% of the test system's minimum efficacy threshold).

5.2.1.3 Termite Exposure: Laboratory data demonstrating that the test system at its minimum efficacy threshold will prevent termite attack and damage is required before a system can be standardized. Testing is required for the two main North American subterranean termite genera, *Reticulitermes spp.*, and *Coptotermes (typically formosanus)*. The preferred method is the AWPA E1 Laboratory Termite test, run as both choice and no-choice tests. Both termite species must be controlled at their respective minimum efficacy thresholds. (less than 3% average wt. loss) and provide similar or better performance (weight loss and visual ratings) than the reference system(s) at their UC4A retentions. Similar or better performance compared to a reference system at proportionally lower retentions (i.e. 50% of the reference system UC4A retention) will provide support for the relative performance of a system against termites at the higher retentions. Positive long-term field test results can compensate for minor differences in AWPA E1 test results. If data is not available or does not support that a test system controls *Coptotermes* species, it cannot be standardized for use in areas where that species is active.

5.2.2 Simulated Field Testing: Accelerated ground contact decay tests can provide strong supporting data when field data is only available for exposures of less-than 5 years. Accelerated "simulated field" tests are recommended to provide additional information on a test system's effectiveness in ground contact. The preferred test method is the AWPA E14 Soil-Bed test. Strong supporting data on the relative performance of the test system compared to a reference system can often be obtained in 3 years. The test system is performing equivalent to or better than the reference system at its UC4A retentions (or percentages of their retentions) and significant decay must have occurred in the reference system samples (less than a 9.5 average soundness rating). Table 1 should be consulted to determine if rating comparisons with reference systems provide strong support for equivalent performance.

5.2.3 Field Testing

5.2.3.1 Field Stake Testing: AWPA E7 stake tests are recommended at a minimum of two geographically separated aggressive ground contact decay hazard sites. As a guideline, test sites are typically deemed aggressive if the mean rating of untreated stakes is < 4 in 2 years for 19x19 mm stakes, or <4 in 3 years for 2x4 stakes. At least one of the sites should have termite activity. Field data from tests that are less than 3 years old will not be considered when setting minimum retention requirements. Smaller stakes tend to produce more rapid decay for comparative purposes, although larger stakes typically provide data that is more relevant to the expected performance of full-size commercial size material. Field tests in the 3-5 years exposure range can provide data useful in supporting minimum retention requirements, although longer field data will provide much stronger support. When determining minimum efficacy thresholds with field data of only 3-5 years, the minimum threshold shall be equal to or greater than the retention that performs equivalent to the reference system for the poorest performing data set. For field test data that has been evaluated for >5 years, then the minimum efficacy threshold may be established considering the overall performance of multiple tests.

To provide direct support for determining efficacy thresholds, field tests must progress to the point where significant decay (mean rating less than 9.5) is occurring in the reference system, allowing comparisons either at the UC4A retentions or similar fractionally lower retentions (i.e. 50% of the target UC4A retentions). With short-duration results (3-5 years, sometimes longer), test system stakes treated to the minimum efficacy threshold should be near perfect (ratings of 9.5s or 10s only). Until significant decay is observed in the reference system, the tests do not provide information that is directly useful in supporting specific minimum retentions. With short-term data where both reference and tests systems are showing no decay or termite damage at the reference system's UC4A retention comparisons at proportionally lower retentions may be relevant to determining the test system's minimum efficacy threshold. Table 1 below is useful in comparing data sets and determining if test and reference systems are performing equivalently.

With shorter term field tests (3-5 years data), there should be concern if more than 10% of stakes at the minimum efficacy threshold retention have an individual rating of <7. If retained samples from any such stakes are analyzed for retention and penetration and they are found to poorly treated, the data from these stakes can be culled, but full disclosure of all such culled data must be submitted to the appropriate AWPA Committees.

5.3 Preservative Depletion: Depletion data is critical to estimating long-term performance of preservative systems, especially when only short-duration field testing results are available. Preservative depletion is often greatest early in an exposure, with the rate of depletion decreasing with exposure time. Data showing the progression of depletion over time can be as important as the absolute amount of depletion.

5.3.1 Laboratory Leaching: Relative performance of new systems will be compared with reference systems to determine the significance of any observed differences in leaching results.

5.3.1.1 Water Leaching: Preferred method AWPA E11

5.3.1.2 Soil Leaching: Is recommended and method AWPA E20 is preferred. Minimum loss of preservative in the test provides additional support for expected long-term performance of a new system especially when limited (less than 5 year) field test performance data is available. Acceptable leaching levels should be based on reference systems with known and well documented levels of preservative loss. Several soil types should be used account for substrate composition effects and leaching data should be reported for both main active ingredient and co-biocide.

5.3.2 Field Depletion

5.3.2.1 From Field Stakes: Preferred method AWPA E7 Section 10. Field depletion data is required for all new preservative systems with less than 5 years data. If only 3-5 year field performance data is available, a minimum of three years depletion data is required from at least one, preferably two test sites. Data after both 1 and 3 years is preferred to determine the expected progression of preservative loss over time, which cannot exceed 20% in the ground-line zone for any given active component after 3 years exposure. With field exposure time greater than 8 years at minimum two geographic locations where the new proposed system at the minimum recommended retention level performs comparably or better than the reference system at UC4A retention, depletion data is not needed.

Appendix: Rationale for Method of Assessing Field Performance Data

Determining whether the ratings of a test group support a comparable performance to a reference system is not always easy, especially as ratings are subjective and individual samples can be on the border between rating descriptions. This is especially difficult early in a field test (3-5 years exposure) when decay is still in its early stages. Both incidence of decay (proportion of stakes with signs of decay) and severity of decay (extent of decay in individual stakes) must be taken into consideration. Average decay ratings do not tell the whole story of relative performance and comparison of how many ratings are in each rating category can provide additional useful information. Some examples are shown in the table below, where greater numbers of samples in lower rating categories are indicative of potential poor relative performance compared to a reference set. As ratings are subjective, and individual stakes can be borderline between ratings groups, results may also vary from one inspection to another. The table below gives examples of how one can use this to evaluate the potential significance of differences in ratings. In this instance, only ratings in categories evaluated as “less-than” ratings of 9 or less are considered, and if there are less ratings in a category, it has a positive influence on the evaluation. Evaluation in this way looks at the number of samples with ratings below specific ratings in each test group, and then sums them up for an overall “rating” to compare with the reference system. If the number is less than or equal to that for the reference system, then it provides strong support for equivalent performance. If the change is plus 1, it is neither positive nor negative, as a single borderline subjective rating can easily result in this difference. A difference of plus 2 is does not support equivalent performance in only 3-5 year data, and is suspect in longer term data, but is only negative if it persists for more than one inspection. A difference of 3 or more is indicative that the test does not supporting equivalent performance at that evaluation time period.

Table 1: Sample Data set for test with 10 replicates of a reference system and 6 products to be compared to that reference system. This data supports that products 1 and 2 are performing equivalent to the reference system. Product 6 may be performing equivalent, but the support is not strong, while products 3 and 5 are definitely suspect and would not support equivalent performance if only short-term (3-5 years) data is available. Product 4 is not performing equivalent to the reference system.

	Ratings for individual samples on a 0 (failed) to 10 (sound) rating scale						
Sample	**Reference**	**Product 1**	**Product 2**	**Product 3**	**Product 4**	**Product 5**	**Product 6**
1	**10**	**10**	**10**	**9.5**	**9.5**	**9.5**	**10**
2	**10**	**10**	**10**	**9.5**	**9.5**	**9.5**	**9.5**
3	**10**	**9.5**	**9.5**	**9.5**	**9.5**	**9.5**	**9.5**
4	**9.5**	**9.5**	**9.5**	**9.5**	**9**	**9.5**	**9.5**
5	**9.5**	**9.5**	**9.5**	**9**	**9**	**9.5**	**9.5**
6	**9**	**9.5**	**9.5**	**9**	**9**	**9**	**9**
7	**9**	**9**	**9**	**9**	**8**	**9**	**9**
8	**9**	**9**	**8**	**9**	**8**	**9**	**9**
9	**8**	**8**	**8**	**8**	**8**	**8**	**8**
10	**8**	**8**	**8**	**7**	**8**	**4**	**7**
Avg	**9.2**	**9.2**	**9.1**	**8.9**	**8.75**	**8.65**	**9.1**
N ≤9	**5**	**4**	**4**	**6**	**7**	**5**	**5**
N ≤8	**2**	**2**	**3**	**2**	**4**	**2**	**2**
N ≤7	**0**	**0**	**0**	**1**	**0**	**1**	**1**
N ≤4	**0**	**0**	**0**	**0**	**0**	**1**	**0**
Sum (change)	**7**	**6 (-1)**	**7 (0)**	**9 (+2)**	**11 (+4)**	**9 (+2)**	**8 (+1)**