FIRE RETARDANT WOOD PRODUCTS ASTM E2768 TEST RESULTS SUMMARY

FINAL REPORT

Prepared by:

kspence
CONSULTING

Kelley Spence
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This report provides an overview and summary of the resuts of a testing program designed to determine if fire retardant coating products marketed as code compliant substitutes for pressure-treated FRTW products are able to achieve the ASTM E2768 test results required for fire-retardant-treated wood used in structural applications under Section 2303.2 of the International Building Code (2024).

The program was funded by Western Wood Preservers Institute (WWPI) and the Southern Forest Products Association (SFPA) and spearheaded by WWPI's Fire Retardant Testing Program Task Group.

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ABOUT THE AUTHOR

Kelley Spence is an environmental engineering consultant with 25 years' experience in the wood products industry. She has extensive experience reviewing and interpreting data as well as experience implementing quality control auditing programs for pressure-treated wood manufacturing facilities.

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INTRODUCTION

Fire retardant-treated wood (FRTW) is chemically treated to slow the spread of flames and reduce smoke production during a fire. This can provide occupants with more time to evacuate and give firefighters a better chance to control the blaze. Many jurisdictions require FRTW in specific applications, such as in multifamily residential buildings, commercial structures, and schools. Using FRTW helps ensure compliance with these regulations, reducing the risk of fires and enhancing overall safety.

The International Building Code (IBC) requires FRTW to undergo specific tests and achieve certain certifications to demonstrate the product meets the building code requirements. Retesting and recertification are required periodically. An understanding of the building code requirements is essential to understanding how products demonstrate code compliance.

Chapter 23 of the 2024 IBC provides minimum requirements for the design of buildings and structures that use wood and wood-based products. In Section 2303.2, the IBC defines fire-retardant-treated wood as *"any wood product that, when impregnated with chemicals by a pressure process or other means during manufacture, shall have, when tested in accordance with ASTM E84 or UL 723 a listed flame spread index of 25 or less. The ASTM E84 or UL 723 test shall be continued for an additional 20-minute period and the flame front shall not progress more than 10.5 feet (3200 mm) beyond the centerline of the burners at any time during the test."*

Section 2303.2.1 of the 2024 IBC further refines this definition by stating, *"Fire-retardant-treated wood is also any wood product that, when impregnated with chemicals by a pressure process or other means during manufacture, shall have, when tested in accordance with ASTM E2768, a listed flame spread index of 25 or less and where the flame front does not progress more than 10.5 feet (3200 mm) beyond the centerline of the burners at any time during the test."*

Section 2303.2.2 describes the pressure process mentioned in Section 2302.2.1 as follows: *"For wood products impregnated with chemicals by a pressure process, the process shall be performed in closed vessels under pressures not less than 50 pounds per square inch gauge (psig) (345 kPa)."*

Section 2303.2.3 allows for wood products that might be impregnated with fire-retardant chemicals by some process other than a pressure process, stating *"For wood products impregnated with chemicals by other means during manufacture, the treatment shall be an integral part of the manufacturing process of the wood product. The treatment shall provide permanent protection to all surfaces of the wood product. The use of paints, coating, stains or other surface treatments is not an approved method of protection as required in this section."*

Section 2303.2.4 specifies that *"wood structural panels shall be tested with a ripped or cut longitudinal gap of 1/8 inch (3.2 mm)."*

ASTM E84, the *Standard Test Method for Surface Burning Characteristics of Building Materials*, and its counterpart, UL 723, measures initial flame spread and smoke development over a period of 10 minutes. The tests are used to establish the Flame Spread Index (FSI) and Smoke Development Index (SDI) for building materials. These numerical values are then used to classify products according to their fire performance. Products that achieve a FSI of 25 or less and a SDI of 450 or less are said to have a "Class A fire rating." The ratings determined by ASTM E84 or UL 723 are used to classify interior wall and ceiling finish materials which are covered in Chapter 8 of the IBC.

ASTM E2768, the *Standard Test Method for Extended Duration Surface Burning Characteristics of Building Materials*, is often referred to as an "extended ASTM E84 test" because it follows the same testing procedures as ASTM E84, only for a longer period of time (20 additional minutes). By requiring the more rigorous ASTM E2768 test method, the IBC reflects the relative importance of the structural wood products to occupant safety as addressed in Chapter 23 compared to the less rigorous ASTM E84 test method for finish materials covered in Chapter 8.

Some manufacturers have relied on the code's "other means" language and have introduced coating products into the FRTW market, claiming the coatings "impregnate the wood" and can be used to substitute for pressure treated FRTW under Chapter 23 of the IBC. Marketers of those products sometimes point to ASTM E84 test results and/or a "Class A fire rating" as evidence the products are "code compliant." However, as described above, the 10-minute ASTM E84 test is not relevant to products covered in Chapter 23 and achievement of a Class A fire rating does not, by itself, mean a product is considered code-compliant under Chapter 23.

Members of the Western Wood Preservers Institute (WWPI) were skeptical of the efficacy of those claims and as a result were concerned for the safety of occupants in buildings where such products are used in place of FRTW. In 2023, WWPI embarked on a testing program intended to determine if these coating products are able to achieve the ASTM E2768 test results required for FRTW used in structural applications under Section 2303.2 of the IBC.

Several pressure-treated products and coating products were selected by the WWPI task group for testing in accordance with ASTM E2768. The products were selected based on the manufacturer's claims that the products qualify for use as FRTW under Section 2303.2 of the IBC and also based on perceived prevalence in the marketplace.

This report describes the products that were tested, the methodologies used to ensure the integrity of the test samples, the testing process itself, and the results. In embarking on this program and providing this report, WWPI acknowledges that achieving the required results from ASTM E2768 testing does not on its own qualify a product for use as FRTW under Section 2303.2 of the IBC. However, failure to achieve those results is sufficient grounds for disqualification.

METHODOLOGY

Test samples were prepared by applying six different brands of fire-retardants to a mix of raw wood substrates which included Douglas fir (DF) lumber, Southern Yellow Pine (SYP) lumber, DF plywood, and SYP plywood. Three of the fire-retardant brands, PTFR1, PTFR2 and PTFR3, were fire retardants applied to the wood substrates via a pressure treating process. The other three brands, Coating A, Coating B and Coating C, were applied per the manufacturers' instructions (i.e., non-pressure applied). The product brand names have been omitted as the aim of this report is to evaluate the categories of pressure treated and non-pressure applied products rather than the individual products themselves.

The following sections detail how the test materials were prepared and delivered to the test facility, and how the tests were administered. Summaries of the test materials are presented in **Table 1** and **Table 2** below.

PTFR1

In June 2024, PTFR1 was applied to 2x6 #2 DF lumber, 2x6 #2 SYP lumber, ¾" AC DF plywood, and ¾" CDX SYP plywood via pressure treatment in accordance with the manufacturer's requirements. Each product/species combination was treated in a separate charge under the observation of an inspector from a third-party agency ("Agency Inspector") accredited by the American Lumber Standard Committee, Inc. The inspector marked the products with their unique stamp to allow for chain of custody tracking from the production facility to the testing facility. In addition, the inspector confirmed each charge met the required treatment quality parameters. The production facility is located in the Chicago, Illinois, area and is a full-scale production facility that regularly manufactures these products for commercial use. Following treatment, the test materials were stored and shipped in a manner to keep them protected from weather.

The inspector-marked test materials were shipped to the ICC Evaluation Service (ICC-ES) test facility in Bryan, TX. ICC-ES received the material in July 2024 and documented the unique markings. Prior to testing, the material was placed in a laboratory conditioning chamber to reach moisture content equilibrium.

ICC-ES personnel set up the test pieces into the test assemblies and tested the material in accordance with ASTM E2768-11 (reapproved 2018) with no deviations documented. Each unique chemical/substrate combination was tested once with no deviations documented by ICC-ES.

PTFR2

In July 2024, PTFR2 was applied to 2x6 #2 DF lumber and ¾" CDX DF plywood via pressure treatment in accordance with the manufacturer's requirements. Each product/species combination was treated in a separate charge under the observation of an Agency Inspector. The inspector marked the products with their unique stamp to allow for chain of custody tracking from the production facility to the testing facility. In addition, the inspector confirmed each charge met the required treatment quality parameters. The production facility is located in the Minneapolis, Minnesota, area and is a full-scale production facility that regularly manufactures these products for commercial use. Following treatment, the test materials were stored and shipped in a manner to keep them protected from weather.

The inspector-marked test materials were shipped to the ICC-ES test facility in Bryan, TX. ICC-ES received the material in August 2024 and documented the unique markings. Prior to testing, the material was placed in a laboratory conditioning chamber to reach moisture content equilibrium.

ICC-ES personnel set up the test pieces into the test assemblies and tested the material in accordance with ASTM E2768-11 (reapproved 2018) with no deviations documented. Each unique chemical/substrate combination was tested once with no deviations documented by ICC-ES.

PTFR3

In September 2024, PTFR3 was applied to 2x6 Tongue and Groove (T&G) #2 DF lumber, 2x6 T&G #2 SYP lumber, ¾" AC DF plywood, and ¾" CDX SYP plywood via pressure treatment in accordance with the manufacturer's requirements. Each product/species combination was treated in a separate charge under the observation of an Agency Inspector. The inspector marked the products with their unique stamp to allow for chain of custody tracking from the production facility to the testing facility. In addition, the inspector confirmed each charge met the required treatment quality parameters. The production facility is located in the Atlanta, Georgia area and is a pilot-scale facility that regularly manufactures these products for R&D purposes, but not for commercial use. Following treatment, the test materials were stored and shipped in a manner to keep them protected from weather.

The inspector-marked test materials were shipped to the ICC-ES test facility in Bryan, TX. ICC-ES received the material in October 2024 and documented the unique markings. Prior to testing, the material was placed in a laboratory conditioning chamber to reach moisture content equilibrium.

ICC-ES personnel set up the test pieces into the test assemblies and tested the material in accordance with ASTM E2768-11 (reapproved 2018) with no deviations documented. Each coating/substrate combination was tested twice with no deviations documented by ICC-ES.

COATING A

Coating A was obtained from Amazon.com by Agency representatives. The product was shipped directly to the Agency laboratory facility in Georgia. In November 2024, the Agency Inspector applied Coating A to 2x6 Select Structural (SS) DF lumber, 2x6 #2&BTR SYP lumber, ¾" CDX DF plywood, and ¾" CDX SYP plywood in accordance with the manufacturer's instructions with no deviations documented. The inspector marked each sample with their unique stamp to allow for chain of custody tracking from the Agency laboratory facility to the testing facility. Following treatment, the test materials were stored and shipped in a manner to keep them protected from weather.

The inspector-marked test materials were shipped to the ICC-ES test facility in Bryan, TX. ICC-ES received the material in December 2024 and documented the unique markings. Prior to testing, the material was placed in a laboratory conditioning chamber to reach moisture content equilibrium.

ICC-ES personnel set up the test pieces into the test assemblies and tested the material in accordance with ASTM E2768-11 (reapproved 2018) with no deviations documented. Each coating/substrate combination was tested twice with no deviations documented by ICC-ES.

Based on the initial test results, it was determined by the WWPI task group that additional testing was desired to further evaluate the potential that the Select Structural grade of the DF lumber had impacted the test results. To accomplish this objective, the task group arranged for follow-up testing to include Coating A applied to lumber of a similar grade to the other test materials as well as untreated Select Structural grade DF lumber (see the Untreated Lumber section below).

A WWPI task group member obtained Coating A from a seller on eBay (it was no longer available on Amazon.com) and applied the product to 2x6 #2&BTR DF lumber in accordance with the manufacturer's application requirements. The test material was allowed to air dry for 3 days and was then packaged and shipped to the ICC-ES test facility in Bryan, TX, arriving in February 2025. Prior to testing, the material was placed in a laboratory conditioning chamber to reach moisture content equilibrium.

ICC-ES personnel set up the test pieces into the test assemblies and tested the material in accordance with ASTM E2768-11 (reapproved 2018) with no deviations documented. This coating/substrate combination was tested once with no deviations documented by ICC-ES.

COATING B

Coating B was obtained by Agency representatives directly from the manufacturer. The product was shipped to the Agency laboratory facility in Georgia. In November 2024, the Agency Inspector applied the Coating B product to 2x6 SS DF lumber, 2x6 #1 SYP lumber, ¾" CDX DF plywood, and ¾" CDX SYP plywood in accordance with the manufacturer's instructions with no deviations documented. The inspector marked the products with their unique stamp to allow for chain of custody tracking from the Agency laboratory facility to the testing facility. Following treatment, the test materials were stored and shipped in a manner to keep them protected from weather.

The inspector-marked test materials were shipped to the ICC-ES test facility in Bryan, TX. ICC-ES received the material in December 2024 and documented the unique markings. Prior to testing, the material was placed in a laboratory conditioning chamber to reach moisture content equilibrium.

ICC-ES personnel set up the test pieces into the test assemblies and tested the material in accordance with ASTM E2768-11 (reapproved 2018) with no deviations documented. Each coating/substrate combination was tested twice with no deviations documented by ICC-ES.

COATING C

Coating C is factory applied by the manufacturer and is only available through authorized distributors. The 2x6 SYP lumber and 5/8" SYP plywood treated with Coating C were obtained from the factory and shipped to an authorized distributor. The grades of the lumber and plywood were not documented.

This material was shipped to the ICC-ES test facility in Bryan, TX. The lumber samples were received in February 2025 and the plywood samples were received in March 2025. Prior to testing, the material was placed in a laboratory conditioning chamber to reach moisture content equilibrium.

ICC-ES personnel set up the test pieces into the test assemblies. ICC-ES tested the material in accordance with ASTM E2768-11 (reapproved 2018) with no deviations documented. Each unique coating/substrate combination was tested twice with no deviations documented by ICC-ES.

UNTREATED LUMBER

As a follow-up to the original test materials, it was determined additional testing was desired to further evaluate the potential that the Select Structural grade of the DF lumber had impacted the test results. A WWPI task group member obtained untreated 2x6 SS DF lumber and had this material shipped to the ICC-ES test facility in Bryan, TX, with the samples arriving in February 2025. Prior to testing, the material was placed in a laboratory conditioning chamber to reach moisture content equilibrium.

ICC-ES personnel set up the test pieces into the test assemblies and tested the material in accordance with ASTM E2768-11 (reapproved 2018) with no deviations documented. The untreated lumber was tested once with no deviations documented by ICC-ES.

SUMMARY

All six fire retardant products were applied in accordance with manufacturer's instructions, were stored and shipped in accordance with manufacturer's instructions, and were assembled and tested by ICC-ES with no deviations noted.

As was documented above, each PTFR product combination was tested once, while the coating product combinations underwent two separate tests, as the test standard requires. The decision to limit the PTFR products to one test was made by the task group because all three products had recently undergone ASTM E2768 testing and the manufacturers had agreed to make those test results available upon request. Since the primary purpose of the testing program was to evaluate the coating products and their ability to achieve the

ASTM E2768 test results required under Section 2303.2 of the IBC, the task group opted to perform these tests twice in accordance with the standard.

Efforts were made by the task group to standardize the substrates tested. The majority of the lumber products tested were 2x6 #2 SYP or 2x6 #2 DF; however, the initial 2x6 DF test materials treated with Coating A and Coating B were a Select Structural grade rather than the #2 grade lumber that was sourced for the other products. Select Structural is the highest structural grade recognized under the National Grading Rule for Dimension Lumber. It is typically specified only in applications for which additional strength is critical. This grade has very few allowable defects and is typically much denser than the more commonly used construction grades. These attributes give Select Structural lumber its high strength properties. It was hypothesized by the task group that the higher density of this material would contribute to increased fire resistance as compared to less dense grades of lumber.

All lumber products had consistent test results within each treatment type with the exception of Coating A. These varied results led the task group to conduct additional testing to further investigate the potential effect of the grade on the performance of the fire retardant products. Details of this additional testing are discussed above in the applicable sections (Coating A and Untreated Wood).

The plywood products tested were primarily CDX grade which is manufactured with an exterior glue and is suitable for limited moisture exposure. Two sets of test materials were AC grade plywood: DF plywood treated with PTFR1 and DF plywood treated with PTFR3. Since these products were pressure-treated, it can be deduced that this AC grade plywood was also manufactured with exterior glue (interior glue would not hold up to the pressure treating process).

Table 1. Summary of Lumber Test Materials

Treatment	Product	Description	Grade	Species
PTFR 1	Lumber	2x6	#2	DF
PTFR 1	Lumber	2x6	#2	SYP
PTFR 2	Lumber	2x6	#2	Df
PTFR 3	Lumber	2x6 (T&G)	#2	DF
PTFR 3	Lumber	2x6 (T&G)	#2	SYP
Coating A	Lumber	2x6	SS	DF
Coating A	Lumber	2x6	#2&BTR	SYP
Coating A*	Lumber	2x6	#2	DF
Coating B	Lumber	2x6	SS	DF
Coating B	Lumber	2x6	#1	SYP
Coating C	Lumber	2x6	unknown	SYP
Untreated*	Lumber	2x6	SS	DF

**Tested to evaluate potential effect of grade on test results.*

Table 2. Summary of Plywood Test Materials

Treatment	Product	Description	Grade	Species
PTFR 1	Plywood	3/4” plywood	AC	DF
PTFR 1	Plywood	3/4” plywood	CDX	SYP
PTFR 2	Plywood	3/4” plywood	CDX	DF
PTFR 3	Plywood	3/4” plywood	AC	DF
PTFR 3	Plywood	3/4” plywood	CDX	SYP
Coating A	Plywood	3/4” plywood	CDX	DF
Coating A	Plywood	3/4” plywood	CDX	SYP
Coating B	Plywood	3/4” plywood	CDX	DF
Coating B	Plywood	3/4” plywood	CDX	SYP
Coating C	Plywood	3/4” plywood	unknown	SYP

RESULTS

All pressure treated and non-pressure applied products were prepared in accordance with the manufacturer's instructions and were tested by ICC-ES with no deviations noted.

A total of 32 tests were performed in accordance with ASTM E2768-11 (Reapproved 2018) by ICC-ES with 10 tests performed on pressure treated fire retardant products, 21 tests performed on non-pressure applied products and one test performed on an untreated product. The test results are presented in Table 3.

The ASTM E2768 test standard does not specifically make pass or fail judgments; however, for the purposes of this report and ease of discussion, a "passing" test result is one in which the flame front did not progress beyond 10.5 feet during the test and a "failing" test result is one in which the flame front did progress beyond 10.5 feet during the test.

Of the tests performed as part of this study, 12 "passed" and 20 "failed". All 10 PTFR products "passed" along with the two tests performed on the 2x6 SS DF that was treated with Coating A.

As discussed in the previous section, the task force sought to understand the potential effect of the wood density by further evaluating untreated SS grade lumber and treated #2 grade lumber. Coating A was applied to 2x6 #2 DF and was tested by ICC-ES; this test material "failed". In addition, untreated 2x6 SS DF was presented for testing; this test material also "failed."

Table 3.
ASTM E2768 Results Summary

**ASTM E2768 test results are not "pass/fail." For simplification, the followng key was chosen:

P = the flame front did not progress beyond the 10.5-ft mark during the test

F = the flame front progressed beyond the 10.5-ft mark during the test

Treatment	Product	Description	Grade	Species	P/F**
PTFR 1	Lumber	2x6	#2	DF	P
PTFR 1	Lumber	2x6	#2	SYP	P
PTFR 1	Plywood	3/4"	AC	DF	P
PTFR 2	Lumber	2x6	#2	Df	P
PTFR 2	Plywood	3/4"	CDX	DF	P
PTFR 3	Lumber	2x6 (T&G)	#2	DF	P
PTFR 3	Lumber	2x6 (T&G)	#2	SYP	P
PTFR 3	Plywood	3/4"	AC	DF	P
PTFR 3	Plywood	3/4"	CDX	SYP	P
Coating A	Lumber	2x6	#2	DF	F
Coating A	Lumber	2x6	SS	DF	P
Coating A	Lumber	2x6	SS	DF	P
Coating A	Lumber	2x6	#2&BTR	SYP	F
Coating A	Lumber	2x6	#2&BTR	SYP	F
Coating A	Plywood	3/4"	CDX	DF	F
Coating A	Plywood	3/4"	CDX	DF	F
Coating A	Plywood	3/4"	CDX	SYP	F
Coating A	Plywood	3/4"	CDX	SYP	F
Coating B	Lumber	2x6	SS	DF	F
Coating B	Lumber	2x6	SS	DF	F
Coating B	Lumber	2x6	#1	SYP	F
Coating B	Lumber	2x6	#1	SYP	F
Coating B	Plywood	3/4"	CDX	DF	F
Coating B	Plywood	3/4"	CDX	DF	F
Coating B	Plywood	3/4"	CDX	SYP	F
Coating B	Plywood	3/4"	CDX	SYP	F
Coating C	Lumber	2x6	unknown	SYP	F
Coating C	Lumber	2x6	unknown	SYP	F
Coating C	Plywood	3/4"	unknown	SYP	F
Coating C	Plywood	3/4"	unknown	SYP	F
Untreated	Lumber	2x6	SS	DF	F

CONCLUSION

There are clear differences in performance between the pressure treated fire retardant wood products and products treated with non-pressure applied fire retardants. All of the pressure treated products (10 of 10) met the objective of the ASTM E2768 test — the flame front did not progress beyond 10.5 feet during the 30-minute test. Nineteen of the 21 products treated with non-pressure applied fire retardants were unable to reach the 30-minute mark without the flame front progressing beyond 10.5 feet.

In the two tests of products treated with non-pressure applied fire retardants that "passed," the products consisted of Douglas fir lumber that was Select Structural grade. When the coating product was applied to Douglas fir lumber of a grade similar to the pressure treated products (#2 grade), the tested product did not last the full 30-minute duration of the test before the flame front passed the 10.5-foot mark; it "failed." As further indication that the product substrate may impact performance, the untreated Select Structural product lasted 27.3 minutes, more than 90 percent of the test's 30-minute duration, before the flame front progressed beyond 10.5 feet.

This program sought to methodically evaluate whether wood buidling materials treated with the selected coating products are able to meet the ASTM E2768 test criteria required under Section 2303.2 of the IBC for fire-retardant-treated wood (FRTW) used in structural applications. It is important to note that meeting the fire testing criteria alone does not make a product code compliant; however, failure to meet that criteria results in a non-code compliant product.

Users of FRTW in critical structural applications should be aware that while producers and marketers of these fire retardant coatings may make claims of "Class A fire ratings" and "code-compliance," if a product cannot meet the rigorous requirements of the ASTM E2768 test, it is not compliant under Section 2303.2 of the IBC.

This testing program's findings demonstrate that wood building materials treated with these coating products are unable to reliably meet the fire-testing criteria required by the International Building Code for FRTW used in structural applications.

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FireRetardantWood.org

Western Wood Preservers Institute
12503 SE Mill Plain Blvd., Suite 205
Vancouver, WA 98684
360-693-9958
wwpi.org