WOODSAFE®

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— EXTERIOR WFX

LIFESPAN EXPECTANCY OF POLYMERIC FLAME RETARDANT TREATED WOOD CLADDING

There is a growing demand on the market for addressing the lifespan expectancy of polymeric flame retardant treated wood cladding. Since there is no harmonized standard for verifying lifespan expectancy in number of years, Woodsafe has conducted a qualitative study in order to provide an estimation of the lifespan expectancy for Woodsafe Exterior WFX. This document provides the main aspects of the study.

EXECUTIVE SUMMARY

This document provides the main aspects of the qualitative study performed at Woodsafe in order to provide the market of a lifetime expectancy Woodsafe' s product, Exterior WFX in the absence of a harmonized standard for verifying lifespan expectancy in number of years. The key findings are:

- Flame retardants based on heat-cured polymeric systems are the only flame retardants currently approved for exterior use.
- Long-time real-life tests shows that flame retardants based on heat-cured polymeric systems are Leach Resistance (LR) with long lasting properties in exterior environmental exposure
- Woodsafe makes the assessment that the polymeric heat cured Exterior WFX lifespan is estimated to be 30 years or longer depending on geographical location, latitude, wood type and application

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HOW TO EVALUATE LIFESPAN EXPECTANCY

It is globally a well-known fact that flame retardants based on heat-cured polymeric systems outperform all other competing solutions when it comes to maintaining the fire protecting properties over time (Reaction to Fire properties). A challenge for the industry is that there exists no deterministic methods to quantitatively determine the lifespan expectancy.

Therefore, Woodsafe has conducted a qualitative study in order to provide the market with an estimation of the lifespan expectancy for Woodsafe Exterior WFX. The three main methods used in the study are:

1. **Experiences from long-time outdoor weathering.** This method is a combination from published international long-term studies, information from commercial actors and our own long-time field service experience with Exterior WFX treated wood.
2. **Tests based on accelerated weathering methods.** Results from tests according to international standards such as ASTM D2898 and EN16755 are crucial in determining compliance and allowance for outdoor use.
3. **Literature review.** Articles, web content and other written material such as commercial product information is central in finding a state-of-the-art knowledge regarding lifetime expectancy of polymeric flame retardant treated wood.

LIFESPAN EXPECTANCY INDICATORS OF POLYMERIC FLAME RETARDANT TREATED WOOD CLADDING IN GENERAL

First of all, it is important to know the nature of the method used in manufacturing of a wood cladding treated with a polymeric flame retardant in order to understand why it is superior to all other known alternatives.

The method uses an advanced heat-curing polymeric system based on water soluble organic polymer system applied to the timber by vacuum pressure followed by a high temperature curing process which promotes polymerization.

This process chemically converts the water-soluble chemicals to permanent covalent bonds with the wood constituents (i.e., lignin, hemicellulose and cellulose), which ensures a long lifespan of the achieved flame retardant properties of the wood.

Independent long-time outdoor weathering studies

The Forest Product Laboratory at the United Department of Agriculture Forest Service in the US undertook a 10-year outdoor weathering study of various fire retardant treatments including Koppers, which is a polymeric flame retardant (LeVan & Holmes). Samples were exposed towards the south with a roof angle of 37,5°.

Results presented in the paper confirmed that the samples treated with Koppers outperformed other methods. It had a flame spread of only 29 inches after 10 years and the treated specimens were the only samples which self-extinguished in the Schlyter tunnel test. The report also concluded that the Koppers treatment had a high degree of leach resistance and outclassed all the alternative treatments.

Accelerated weathering tests

In order to simulate long-term real-life behaviour of the fire retardant treated wood, accelerated weathering tests are used. These are designed to, among other things, expose leaching behaviour problems of the fire retardant chemicals used (see Appendix I for a historical background of the most common accelerated weathering tests used globally).

These test methods have been incorporated into standards over the world, for example, the ASTM D2898 standard in the US and EN16755 in the European Union. Available test results, both in the public domain and from manufacturers, clearly shows the same pattern in the results: It is only wood that have been treated with the polymeric flame retardant as described above that are approved for exterior use in cladding, i.e. that survives the heavy test conditions in ASTM D2898 and EN16755.

Literature review

Internationally there are several studies done over the last decades that clearly illustrate the supremacy of polymeric flame retardants when it comes to durability and lifespan expectancy for flame retardant treated wood.

Russel et al. states that the only flame retardants currently approved for exterior use, are those based on heat-cured polymeric systems.

Timber treated with these systems is not considered to be preservative treated, although it has been shown that this timber is more durable than if it were untreated.

Consequently, the Wood Protection Association (WPA) in the UK has acknowledged this fact in their Specification – Service Environment and Treatment Types, states how the WPA recommended treatment for unprotected exterior cladding, Type EXT, is obtained: "Leach resistance is brought about by high temperature curing of the complex chemical system in the treated wood following impregnation and re-drying". WPA & EN16755 Type EXT is suitable for EN1995 Service Class 3 applications, the most severe category.

Benchmark
APPROVED TREATER
WPA
Certificate no: FR-201901

LIFESPAN EXPECTANCY FACTORS OF EXTERIOR WFX IN PARTICULAR

Exterior WFX, is a flame retardant agent based on advanced heat-curing polymeric system based on water soluble organic polymer system applied to timber by vacuum pressure following by a high temperature curing process which chemically converts the water-soluble chemicals to a permanently bonded high molecular weight water insoluble resin.

This results in permanent non hygroscopic flame protection with leach resistance properties (LR). WFX treatment is undertaken at the Woodsafe Timber Protection production facility in Sweden, which is an accredited service treatment centre according to ISO 9001:2015 and ISO 14001:2015.

Based on our best knowledge and available facts from global sources that the only flame retardants currently approved for exterior use are those based on heat-cured polymeric systems, we feel confident in the long - lasting properties of the product.

The timber treatment operations of

Woodsafe Timber Protection AB
Fågelbacken Tillbergaleden Västerås Sweden

have been assessed and certified as meeting the requirements of the Wood Protection Association

Benchmark Quality Approval Scheme

for the fire retardant treatment of the components listed below in accordance with the standards and practices defined in the WPA Flame Retardant Specification Manual.

Approved FR Treater

Solid wood panelling and cladding treated with Woodsafe FirePRO fire retardant.

Solid wood panelling and cladding treated with Woodsafe Exterior Fire-X.

Detailed clarification of the scope of this certificate and the applicability of the Benchmark quality scheme is available from the Wood Protection Association.

The scheme does not confirm compliance of the fire retardant used with British or European Standards or other specifications - that is the responsibility of the fire retardant manufacturer.

This certificate of conformity is valid until the date indicated and remains valid subject to satisfactory audits by the WPA.

Authorised by:

Chris Coggins
WPA Quality & Standards Director

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Certificate firm no. FR201901

Valid to: 1 December 2021

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International acknowledgement

The flame retardant manual from Wood Protection Association (WPA) in the UK classifies Exterior WFX as a Leach Resistant (Type EXT) product which means that treated wood and board products can be used in all interior and exterior applications with no requirement to apply top coating such as paints. All wood species are included in the approval.

US approvals and supporting data

It all started in the US with the need of flameproofing cedar shingles and shakes. Since the first approval by Underwriters Laboratory, the use of WFX treated timber continues to be reviewed and re-approved as Class A material.
The original flame retardant has passed the US building most stringent codes of flame retardant tests and have passed the Uniform Building Code Standard 10 years natural weathering test based on the Underwriters Laboratory UL-790. This requires roof test decks to be flame tested after 1, 2-, 3-, 5- and 10-years natural weathering.

To qualify as a Class A material, the US model building codes require a flame spread rating of 25 or less and a smoke developed rating of 450 or less, when the standard surface burning test after accelerated weathering is extended to 30 minutes.

*Test extended to 30 minutes and after completion of ASTM D2898 weathering. (origin method to EN16755)

Solid Timber	Flame Spread*	Smoke Development*
Soutern pine	15	20
Douglas Fir	15	0
Western Red Cedar	20	45
Spruce	2	0

CONCLUSION

Based on international 10-year outdoor weathering studies, our own compliance with European Union standards that incorporate accelerated weathering methods, our own extensive experience in international Exterior WFX projects and an extensive literature review, Woodsafe makes the assessment that the polymeric heat cured Exterior WFX lifespan is estimated to be 30 years or longer depending on geographical location, latitude, wood type and application.

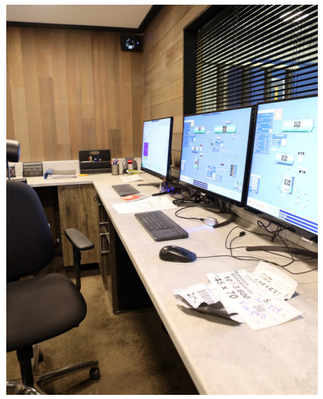
Our statement is also based on the experience of more than 50 years of manufacturing of the heat-curing polymeric system with distribution worldwide where more than 10 million cubic meters have been used in North America only and supporting approved test results according to ASTM D2898, EN16755, American Society for Testing and Materials (ASTM) test method E-84 (commonly known as the Steiner tunnel test), ASTM E108-20a, ASTM E1354, ISO 5660-1, EN13823 and EN927: 6.

Finally, as there is no harmonized standard for verifying lifespan expectancy in number of years, Woodsafe Timber Protection disclaims formal or legal responsibility for the lifespan expectance estimation given in this document.

ABOUT WOODSAFE®

The Woodsafe method is a refining process using vacuum pressure impregnation which is an accepted process for impregnating wood around the world. The process is regulated by a specially developed control program, where a specific amount of fire protection agent for the wood type and fire class in question are monitored. The principle for refining the properties of the wood means that oxygen in the wood is removed through a vacuum. Fire retardants are then added under a constant vacuum which, once the autoclave is filled, reach pressures of up and ratios according to the specific wood type and fire class.

Our production is ISO 9001 certified, our long-term sustainability environmental work is ISO 14001 certified, and our production is under surveillance and continuous manufacturing control by RISE (No.body 0402) in accordance with the requirements of CPR 305/2011, Annex ZA, AVCP system 1 and 8 chap. 22 and 23 of the Plan, and the Building Act (SFS 2010: 900) and 4 § 2 and 3 PBL and the National Board of Housing building regulations (BBR) 2:2, 5:231, 5:551, points 2, 3 and 4, 6:21.



APPENDIX I: HISTORICAL BACKGROUND OF ACCELERATED WEATHERING TESTS

The background to EN16755 began in the United States in the 1970s. The world's largest market for fire-impregnated wood. ASTM International, originally the American Society for Testing and Materials, is a non-profit standardization organization founded in 1898, now with members from about 120 countries. ASTM International Standard D2898 contains recognized methods for natural or accelerated removal of wood treated with fire retardants.

The method is developed and intended for wood products treated with fire-retardant chemicals by vacuum pressure impregnation rather than surface coating. The ASTM D2898 standard was originally approved according to Method A and Method B as early as 1970 in the United States.

The EN16755 standard is based on ASTM D2898, which has more than 50 years of research funded by the U.S. Forest Service Forest Products Laboratory. In connection with the increased need to protect cedar fires in North America in the 1960s, ASTM D2898 was adopted. The two original methods in ASTM D2898 are also the basis for the Nordtest method NT Fire 053 on accelerated aging of fire protection treated wood products.

Method A is the rain test in the Underwriters Laboratories (UL 790) and ASTM (E 108) standards for testing roof coverings, such as fire-impregnated wood shavings, and the one generally specified for fire-impregnated wood for outdoor use.

The exposure in method A is limited to water spray and heat for a total duration of 12 weeks.

- Method A and method B gave similar fire test results for a lacquer-resistant treatment and a non-lacquer-resistant treatment (Holmes 1973) and which is equivalent to EN16755.

- Method B is associated with a climate chamber developed at U.S. Pat. Forest Service Forest Products Laboratory (FPL) and includes exposure to ultraviolet light (UV) in addition to water spray. The UV exposure is provided by reflector type sun lamps. The total duration of method B is 6 weeks (half the time of method A).

Method B exposure was an adaptation of a method specified by the City of Los Angeles in 1964 for a wood chip weather test. Water spray in method B has flow rates that are 40 times greater than those in method A, but the total duration of water spray is 29% of method A.

Source: https://www.fpl.fs.fed.us

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Notes

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