BROCHURE

Borogard® ZB in woodfiber-plastic composites

20 MULE TEAM BORAX™
Rio Tinto

Weather takes a toll on both the plastic and wood components of woodfiber-plastic composites (WPCs) leaving them susceptible to rot, decay, mold, and degradation.

WPCs continue to evolve and have now become the fastest growing segment of the outdoor decking market. They offer a wide range of advantages over pressure-treated lumber and naturally durable cedar or redwood, including weather resistance, long service life, and low maintenance.

Consumers rank durability as the most important attribute in choosing decking material, followed by low maintenance and appearance.[1] To meet this demand, WPC manufacturers rely on *Borogard*® ZB. *Borogard* ZB protects against wood destroying organisms such as decay fungi to enhance durability; and, inhibits mold growth to keep decks looking good and easy to maintain.

Initially, the perceived advantage of WPCs over solid wood was the "fact" that the wood fibers were completely encapsulated in plastic—preventing exposure to wood destroying organisms and the moisture absorption that creates a welcoming environment for many of them. That fact turned out to be a myth. In reality, weather takes a toll on both the plastic and wood components of WPCs—particularly in the exterior applications they were designed for—leaving them susceptible to rot, decay, mold, and degradation.

Borogard ZB has been used successfully to protect wood composite products for more than 25 years, making it the benchmark against which other preservatives are measured. *Borogard* ZB is safe for people and the planet, the most cost-effective preservative available, and offers these vital performance attributes:

- Protects against rot and decay
- Inhibits mold in exterior applications
- Enhances UV light stabilization

Protects against rot and decay

The wood component of WPCs is inherently susceptible to moisture absorption—something that is not always reflected in standard industry evaluation methods. In tests, full-sized boards soaked in water for 24 hours show weight gains of about 2%. This translates to a wood moisture content of about 4% in WPCs made with equal amounts of wood and plastic.

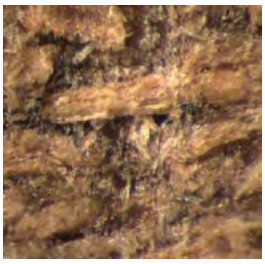
These tests are not, however, an accurate reflection of what happens to WPCs in the real world. Field tests run on WPCs have shown that exposure to the elements for upwards of one year can yield moisture content for the wood component which are high enough to initiate and support fungal decay. Wood moisture content in excess of 40% have been achieved—far above the minimum of 25% that constitutes the necessary environment for decay fungi to begin destroying wood. Not surprisingly, susceptibility to decay and rot has been demonstrated in untreated WPC samples that have been in the field for less than 18 months.

Field tests show decay fungi thriving on untreated WPCs.

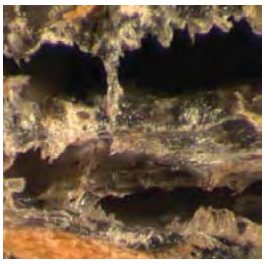
BROCHURE: BOROGARD ZB IN WPCs

These two images show the surfaces of WPC samples exposed to decay fungi in a laboratory soil block evaluation at 25X magnification. The WPC on the left was treated with *Borogard* ZB, and an untreated sample of similar composition is on the right. The decay fungi completely digested the wood, leaving void spaces in the plastic.

Treated with *Borogard* ZB



Untreated



Borogard ZB for built-in protection

Independent university research confirms these findings. Standard laboratory tests of untreated WPCs' performance against decay fungi show weight losses of between 10 and 20% in as little as 16 weeks. These losses equate to a reduction of between 20 and 40% of WPCs' wood component. Field tests show that natural weathering makes WPCs even more susceptible to decay and rot.

Research also proves there is a solution. In test after test, WPCs treated with *Borogard* ZB resisted a full range of wood-destroying organisms. *Borogard* ZB's biostatic properties, low cost, and excellent safety attributes make it the leading preservative treatment available.

Inhibits mold in exterior applications

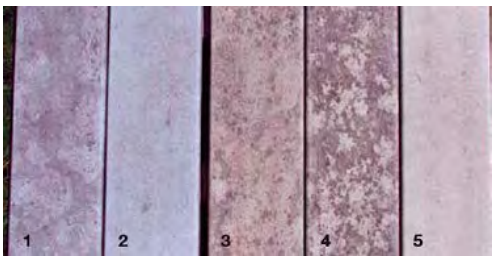
Consumers want decking materials that look good and are easy to maintain. Unfortunately, another of wood's natural enemies—mold—can wreak havoc on WPCs, both in inventory and in use. Mold can stain the surface of WPCs, effectively eliminating the "low maintenance" advantage and dramatically impacting the appearance.

However there is good news from the lab and the field: *Borogard* ZB's biostatic properties inhibit mold in exterior applications. In laboratory and outdoor field tests, *Borogard* ZB has been shown to dramatically reduce the appearance of unsightly mold.

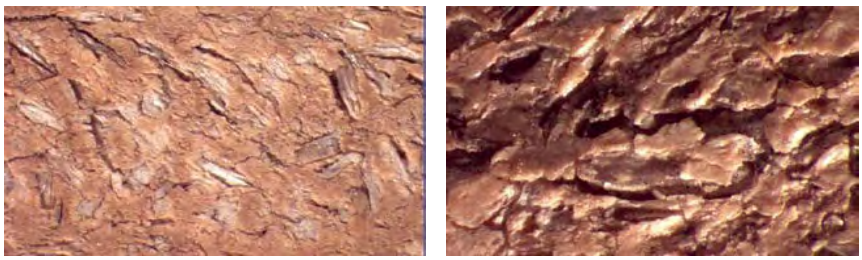
Enhances UV light stabilization

WPCs are under attack even on dry, sunny days. Ultraviolet (UV) light degrades the plastic component of WPCs, leaving the wood component exposed. WPCs are more susceptible to UV degradation than pure plastic systems, most likely because wood's natural vulnerability to UV degradation accelerates the breakdown rate.

Hindered amine light stabilizers (HALS) have long been used to protect plastics against UV degradation, often in combination with UV light absorbers. *Borogard* ZB acts as a synergist to boost the HALS system's performance. Tests conducted on WPCs containing HALS and *Borogard* ZB show a significant reduction in UV degradation compared to samples without *Borogard* ZB. Slowing down this plastic degradation helps to protect the surface of WPCs, minimizing the exposure of the wood component, and its related susceptibility to mold, rot, and decay.



Visual results of aesthetic mold on WPC boards after 3.5 years in an outdoor field test. Boards 1, 3, and 4 do not contain *Borogard* ZB; boards 2 and 5 are treated with *Borogard* ZB.



WPC samples at 10X magnification after 3.5 years in an outdoor field test. The image on the left is a sample treated with *Borogard* ZB and HALS; the image on the right is a sample treated with HALS, but no *Borogard* ZB.

BROCHURE: BOROGARD ZB IN WPCs

The building products industry has relied on *Borogard* ZB for more than 25 years as the benchmark preservative treatment for engineered wood products. *Borogard* ZB is the only zinc borate preservative produced in the United States, and the only one consistently produced using the highest quality raw materials—leading to a final product with extremely low levels of impurities. Since 2000, a growing number of WPC producers have recognized this and are choosing *Borogard* ZB for its process and product benefits:

Excellent performance

Borogard ZB:

- Has broad-spectrum efficacy against all wood destroying organisms
- Is a completely reacted zinc borate and is distributed homogenously throughout the WPC. Its protection is continuous—despite surface abrasion, end cuts, and sanding that occur during installation
- Is thermally stable under WPC manufacturing conditions, and simple to introduce into existing manufacturing processes
- Has a particle size and shape that is optimized to yield a sparingly water-soluble product—making it resistant to leaching and weathering over a longer time period than competitive products
- Acts as a synergist to boost HALS performance

Excellent cost

Borogard ZB is the most cost-effective protection available for WPCs and other composites.

Excellent safety

Borogard ZB is effective against insects and fungi, but safe for people, pets, and the environment.

Reference

[1]Smith PM, Wolcott MP. 2005. Wood-Plastic Composites in Emerging Products and Markets. In: Proc. The Eighth International Conference on Woodfiber-Plastic Composites. Forest Products Society; Madison, WI. pp 335-343.

About U.S. Borax

U.S. Borax, part of Rio Tinto, is a global leader in the supply and science of borates—naturally-occurring minerals containing boron and other elements. We are 1,000 people serving 650 customers with more than 1,800 delivery locations globally. We supply around 30% of the world's need for refined borates from our world-class mine in Boron, California, about 100 miles northeast of Los Angeles.

About 20 Mule Team products

U.S. Borax produces the *20 Mule Team*® borates family of products from naturally occurring minerals and have an excellent reputation for purity and safety when used as directed. Borates are key ingredients in a number of industrial applications including fiberglass, glass, ceramics, batteries and capacitors, wood preservatives, and flame retardants.

High quality, high reliability, high performance borate products. It's what we're known for.

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