

# Research Into Pre-Treatments Yields Landmark Results

*Remedial treatments also found valuable*

*Editor's note: The following staff article is based on the groundbreaking work presented by Dr. Terry Amburgey of Mississippi State University at the 2002 RTA Convention. The full research paper should be available at press time and will be posted soon on RTA's website, [www.rta.org](http://www.rta.org). This overview was written in consultation with Dr. Amburgey and is based on the analytical work used to develop this research report.*

The value of borate-based products as wood preservatives has long been documented. In fact, it might be said that borate-based wood preservatives are almost a perfect wood preservation product—except for at least one aspect: they remain soluble in water and are thus limited in use with wood exposed to constant wetting and rewetting cycles. Others would further argue that there are inherent limitations to water-based only products when exposed to the elements.

So, the need for borates has been to develop a system that allows the product to act in its most efficacious way, while being protected from leaching in exposed applications. This system may finally be a reality—at least for crosstie application.

In 1987, research was undertaken by RTA and others to determine if sodium borate could be introduced into heavy timber products (crossties) via a pre-treatment process and protected from leaching by an over-treatment of creosote. The goal was simple—treat several hundred ties in a prescribed manner, place them in track in various locations, and then measure their performance and preservative levels through the years.

The hypothesis that was being tested was that treating unseasoned ties with borates would protect them from decay and insects during the air-drying process, which would lead to better quality ties being installed in track. Further, it was presumed that, once in track, the ties would receive continuing protection due to the

water diffusible nature of sodium borate.

The test procedure began with treating several hundred red oak, white oak and gum ties at the Somerville, Texas, wood treatment plant. There, the ties were subjected to a three-minute hot bath—or dip treatment—of 30 percent boric acid equivalent (BAE) sodium borate. The ties were then dead-stacked and covered for six weeks to allow the borates to diffuse throughout the wood. Diffusible borates under the right conditions and the presence of moisture—in this case, green ties—will migrate and “treat” the wood without the use of pressure.

After this, the ties were stacked for air-drying in the normal manner. Several months later, when the ties were dry enough to treat, they were pressure preserved and, in a supplemental test, dip treated with creosote.

These ties were then sent to several test sites for installation in main-line track.

The ties were inspected in 1992 and again in 2002. The 2002 inspection produced some remarkable findings.

After 15 years in main-line, fully signaled track in a Deep South test site in Cordele, Ga., the ties that were pre-treated with sodium borate, then pressure preserved with creosote, retained an average above threshold level of borates throughout the cross-section. This simply means that the level of borates found after 15 years of service were still high enough to prevent insect and fungal decay organisms from attacking the wood.

#### **Other observations were as follows:**

- Incised ties picked up more borates than non-incised ties.
- There was no evidence of any “spike-kill” in any of the borate-treated ties.
- There was no evidence that borate-treated ties influenced electronic signaling in the test track areas.
- Vapor drying borate pre-treated ties after the six-week diffusion storage process resulted in a significant loss of the borate in the wood.

- Higher levels of borates were observed in the lower half of the ties than in the top half after 15 years in track.
- In the ties that were over-treated by only dipping in creosote, rather than pressure treating them with creosote, below-threshold levels of borates were found. However, no decay was observed in these ties.

In addition to the tests described above, remedial treatment tests were also conducted with borate-based products. In these tests, a variety of application methods were employed. Rods, pads and spray-on applications were all tested. The observations regarding these remedial products were:

A) After 15 years in track, above-threshold levels of borates were observed in creosote-treated ties where borate rods were inserted near the inner spike holes.

B) After 15 years in track, above-threshold levels of borates were observed in creosote-treated ties that had had a 30 percent BAE sodium borate spray treatment in the tie plate area.

C) After 15 years in track, below-threshold levels of borates were observed in creosote-treated ties where copper-borate pads had been placed under the tie plate. However, there was no evidence of spike-kill or decay in these ties.

All the conclusions cannot be formed until the complete research paper is finalized, but there is now significant evidence that borate pre-treatments and remedial treatments can enhance the long-term performance of wood ties in high-decay hazard areas. This research into wood tie preservation offers railroads immediate and long-term benefits.

First, starting today, railroads now know with confidence that there are remedial treatments that can be applied to ties already in track in decay prone areas that will provide at least 15 years of preservative benefit. And, second, in ties that are destined for use in high-decay hazard areas, the treating industry can offer an enhancement to the creosote-treating process that is proven to be of value for at least 15 years of service. §

**ACKNOWLEDGEMENTS:** The complete list of acknowledgements will be provided in the research report. Special thanks is due to the following primary participants: Norfolk-Southern Corp., Jimmy Watt of The Crosstie Connection, Osmose Inc., and U.S. Borax.



A test tie in the Cordele, Ga., test is being removed from the track for evaluation.